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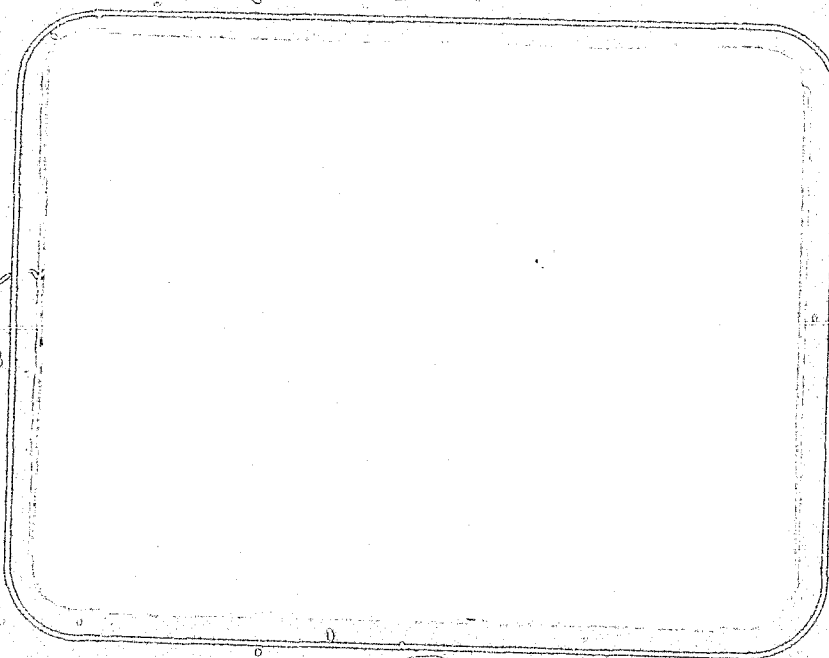
(NASA-CR-162437) EVALUATION CRITERIA FOR  
COMMERCIALY ORIENTED MATERIALS PROCESSING  
IN SPACE PROPOSALS Final Report (Battelle  
Columbus Labs., Ohio.) 58 p HC A04/MF A01

N80-11112

Unclas

CSCL 22A G3/12 46128

# Report



FINAL REPORT

on

EVALUATION CRITERIA FOR COMMERCIALY ORIENTED  
MATERIALS PROCESSING IN SPACE PROPOSALS  
(Report No. BCL-OA-TFR-78-5)

by

W. F. Moore and J. R. McDowell

Sponsored by

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
OFFICE OF SPACE AND TERRESTRIAL APPLICATIONS  
(Contract No. NASw-2800, Task No. 32)

January 1979

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## PREFACE

The study reported herein was carried out by Battelle's Columbus Laboratories for the NASA Office of Space and Terrestrial Applications, and represents the first portion of a two-part task under Contract No. NASw-2800. The work was done under the general supervision of Dr. A. C. Robinson, Battelle's manager for the contract.

Task 32, involving commercially oriented materials processing in space (MPS), is being conducted in two parts, and two reports are being issued to document the progress of work. The first of these reports is presented here. The report describes the approach taken and how the 45-day study was accomplished by Battelle's Columbus Laboratories (BCL). The report summarizes the results of the study and provides recommendations as to an approach and criteria for evaluating proposals which have commercial potential and for selecting qualified individuals to help review such proposals.

Battelle would like to acknowledge the efforts of Richard L. Brown of the Marshall Space Flight Center, who was the technical monitor for this task.

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TASK REPORT  
on  
EVALUATION CRITERIA FOR COMMERCIALY ORIENTED  
MATERIALS PROCESSING IN SPACE PROPOSALS  
to  
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
Washington, D. C.  
from

Battelle Columbus Laboratories  
Contract Number NASw-2800  
December 21, 1978

INTRODUCTION

Research in materials processing in space (MPS) has been carried out, over the past several years, on manned and unmanned NASA space missions and in ground-based research. These research activities, coupled with the introduction of NASA's Space Transportation System, indicate that the future for commercially oriented MPS should be promising. Toward this end, NASA plans to solicit experiments and demonstrations in MPS which have commercial potential. These experiments and demonstrations will be funded by NASA. The commercial nature of the responses to be received by NASA will present a new situation with regard to evaluating and selecting qualified proposals. In the past, NASA has evaluated proposals considering their scientific value and has used scientific peer groups to help review those proposed scientific investigations. The commercially oriented proposals will present a need for judgment based on potential commercial value. Therefore, a new approach and new criteria should be considered for evaluating the commercially oriented proposals. Further, special care and criteria should be used to select qualified individuals to help evaluate the proposals considering their commercial merits.

### TASK OBJECTIVES

The objective of this task is to develop, as Part A, an approach and criteria for evaluating NASA-funded experiments/demonstrations which have commercial potential. The evaluation covers responses to NASA Announcements of Opportunity (AO) and unsolicited proposals received by NASA for commercially-oriented MPS experiments and developments. The task has a further objective, as Part B, to develop criteria for selecting qualified individuals who can review proposals and make recommendations to NASA on their commercial merits.

### THE COMMERCIALIZATION PROCESS

It is important to delineate the process of commercializing a technology so that it can be understood why the commercially oriented proposal presents a unique situation to NASA with regard to evaluation and selection. Figure 1 is representative of the commercialization process and shows the approach for ultimately commercializing MPS experiments and demonstrations. This process should result in an operational system representing full commercialization that will ultimately be fully sponsored and controlled by a commercial organization doing routine MPS. The dotted box in Figure 1 refers to the materials process research which NASA has sponsored or is sponsoring to explore and verify the effect of microgravity on physical, chemical and biological processes. This includes studies, laboratory experimentation and limited flight demonstrations.

It is assumed, therefore, that the NASA solicitation of proposals for commercially oriented experiments and demonstrations deals with the development of technology (as indicated by Phase I on Figure 1) which has been previously researched to the point of ascertaining that a materials process is technically benefited by microgravity. A commercial application or economic benefit will, most likely, have been implied. Therefore, it is assumed that NASA will be soliciting proposals (experimentation or demonstrations) regarding the development of a materials process technology, e.g., containerless processing or processing of immiscible materials, which NASA is willing to fund if the proposer presents a convincing scenario of the commercial merits, commercial probability and a projected commercialization

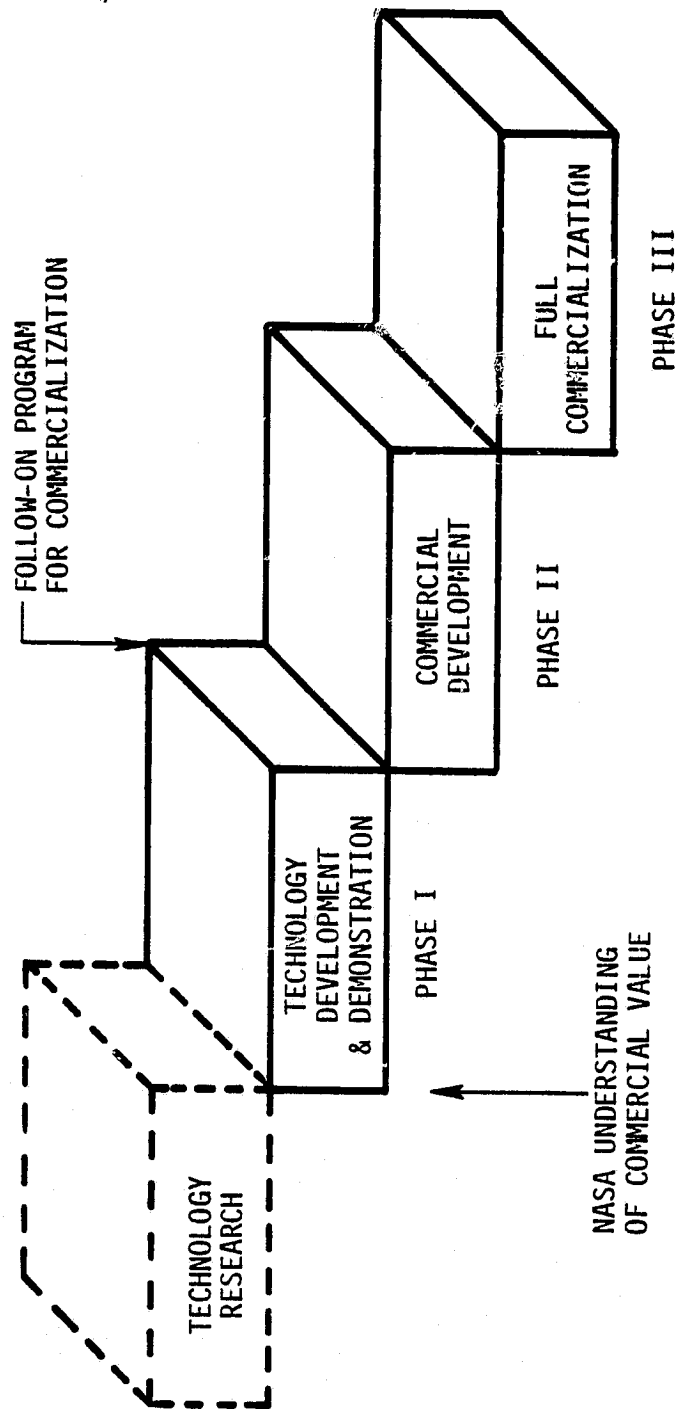


FIGURE 1. COMMERCIALIZATION PHASING



plan (including costs, risks, market, etc.). Unlike the scientific research proposals, NASA must evaluate commercially oriented proposals where the follow-on and eventual use represents a product and market world as compared to the research world NASA is familiar with.

There will be a significant difference in the control and participation that NASA exercises in the commercial development resulting from commercially oriented proposals compared with that exercised in the more familiar scientific programs. In the scientific research activity, NASA maintains complete control throughout the experimental and space mission process. It should be expected that, in the commercial activity, NASA's control will diminish as the commercial activity flows from Phase I through Phase III (except for STS Operations). Therefore, the primary emphasis, by NASA, must be on the evaluation of proposed experimentation and demonstrations to support the objective of Phase I and must be supplemented by an evaluation of the proposer's understanding and projections of the considerations and risks associated with the follow-on potentials of Phases II and III.

A main point to be made from Figure 1 is that NASA, in encouraging commercial developments, is launching a technology development program that should have an impact on a commercially oriented market. Therefore, NASA should have a reasonable understanding of the commercial value of the proposed experiment/demonstration before deciding which proposals they will accept and fund under the technology development activity.

As stated earlier, the goal is to arrive at commercial processes/products. In order to achieve that goal it will be necessary to develop the commercial technology (based on sound research); develop a follow-on program for commercialization (similar to pilot plant or prototype production) and finally a plan for total utilization (full commercialization) of the process/product.

The approach outlined in Figure 1 does not necessarily imply that a single proposer will carry through all three phases. In fact, it is to be expected that many proposals will cover only Phase I or Phase II with Phase III, perhaps, assigned to another party. Some organizations might not have all the skills and resources necessary. The entire commercialization process should, however, be conceived as an integrated initiative, under the general control of a single organization.

As indicated, Figure 1 represents a time phasing of the commercialization process. It also, however, represents the level of knowledge available to the proposer and NASA and, therefore, suggests a criterion for evaluating the proposals. Phase I emphasis is on technical feasibility and technical approach, whereas Phases II and III are weighted more towards market analysis and business evaluation. Since technical feasibility is related to the research that supports the technology, there should be sound data to support the acceptable proposals entering Phase I. While it is important that NASA have an understanding of the commercial value of the proposal before committing to Phase I, it should be recognized that in many instances the level of information will be more judgmental than quantitative. On the other hand, when a good technology development has completed Phase I, there should be enough data about the process to allow a clear understanding of the commercialization cost and potential market.

Therefore, initially, the proposals should be evaluated and ranked according to their technical soundness.

#### TASK GROUND RULES/APPROACH

The ground rules established for conducting this study task are as follows:

- Where appropriate, existing procedures and regulations will govern the handling and selection of proposals.
- The evaluation process should, to the maximum extent possible, result in encouraging commercially sound and creative/innovative proposals.
- The criteria for selection should be equitable for all proposers regardless of their size, i.e., corporation, institution, small business and individuals.
- The evaluation process and criteria for selection should provide proper protection to both the proposer and the U.S. Government.

The study task was approached on the basis that NASA has an established system that guides the issuance, response, evaluation and selection of science and applications investigations. These data are provided in NASA Handbook 8030.6, Guidelines for Acquisition of Investigations. These guidelines were reviewed from the viewpoint of their applicability to commercial developments versus their intended use for scientifically oriented activities in space. The similarities and differences of commercially oriented activity were considered and noted. Recommendations are presented for modification of the present procedures required by the unique commercial environment. There is no attempt to establish guidelines for internal NASA management procedures governing approval of proposal selection; however, issues are delineated that may suggest changes within NASA.

The approach to the task also considered current statutes and regulations concerning the handling of proprietary information in the government. The impact of these data are discussed and suggestions for revisions are presented.

NHB 8030.6 is included in this report as Appendix A. It is recommended that recipients of this report who are not familiar with NHB 8030.6 read Appendix A before proceeding further.

#### PART A - RECOMMENDED PROPOSAL EVALUATION APPROACH AND CRITERIA

This section of the report covers Part A of the Statement of Work which requires the contractor to:

- Develop an approach and criteria for evaluating and selecting NASA-funded experiments/demonstrations which have commercial potential.

The overall approach for evaluating commercially-oriented proposals can be broken down into interrelated steps with each step representing a specific decision point. Figure 2 shows the five major steps proposed and the flow of supporting or resultant events necessary to arrive at the final evaluation.

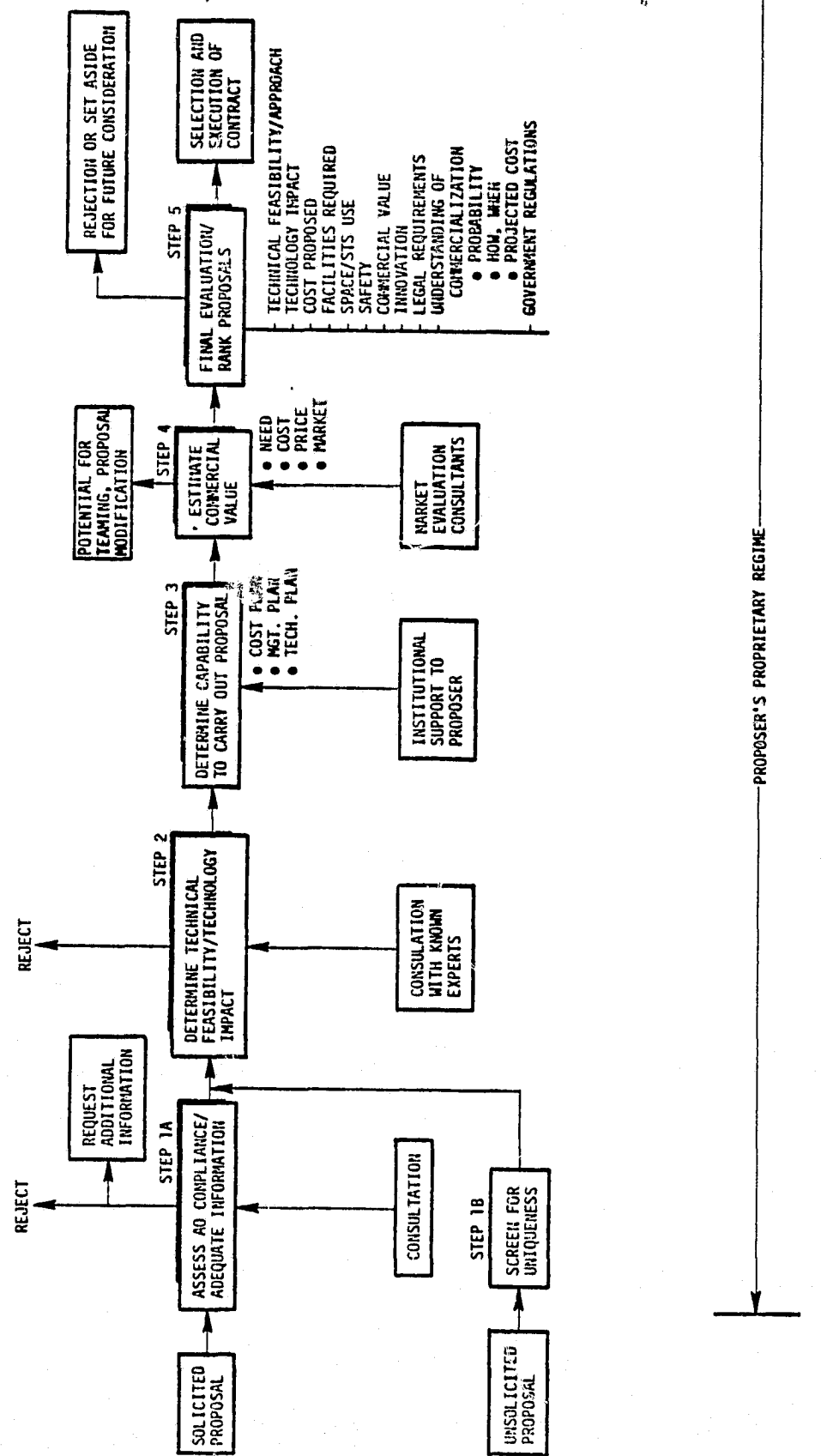


FIGURE 2. EVALUATION STEPS FOR COMMERCIALLY ORIENTED PROPOSALS

The technique recommended for carrying out the evaluation process is as follows. First, NASA should conduct a quick initial screening (Step 1) to determine AO compliance and to eliminate undesirable proposals, i.e., proposals that are not in conformance with the goals of the commercial materials processing program. To accomplish the screening NASA will need to consider, in a broad sense (often judgmental), the elements of evaluation shown in Figure 2 (Steps 1 through 4). Unsolicited proposals may be rejected, as a result of this preliminary screening, if the technology development proposed is related to a potential commercial application not within or compatible with NASA goals.

For those proposals that pass the initial screening NASA should then perform an in-depth technical analysis (Step 2) in order to prove the technical feasibility of the proposal. Subsequent to establishing the technical soundness of the proposed technology development, then the proposal may be evaluated in sequential or parallel steps to determine the proposers' capability to carry out the proposed experiment or demonstration (Step 3) and the projected commercial value of the results (Step 4). The final evaluation and ranking of the proposals (Step 5) should include an assessment of the results from the in-depth evaluation performed on Steps 2, 3 and 4. These steps are described in more detail in the following paragraphs.

#### Step 1--Assess AO Compliance/Uniqueness

In the case of solicited proposals (proposals submitted in response to a NASA AO), the first step is to determine if the proposal is responsive to the AO. In general, it is assumed that deficient responses will fall into one of five categories. They are:

- Proposal is unresponsive and rejected.
- Proposal addresses all requirements but contains insufficient detail for evaluation.
- Proposal is mostly responsive but lacks detail in some areas.
- Proposal is acceptable but inadvertently left out some minor element--such as travel requirements.
- Proposal is entirely responsive.

Each of the above categories, with the exception of the first and last, will require further evaluation. In the case of the second category, it will be necessary to contact the proposer for additional information. This category requires the most careful handling because these responses will likely come from organizations and individuals not fully schooled in the AO process. If NASA wants to encourage creative/innovative ideas, then it may be necessary to provide assistance to proposers who do not fully understand the level of detail required for a government decision. This suggests that the AO contain a provision allowing maximum flexibility for discussions with proposers.

The third category (mostly responsive) warrants a more detailed evaluation which would result in requesting specific information. It could also require consultation with experts to determine whether the proposal is significant enough to warrant more information or whether it should be rejected.

The fourth category (inadvertant omission) is assumed to have been submitted by a competent individual or organization. The evaluation, having determined the quality of the proposal, should request that the missing data be submitted within a specified time frame.

From the above it can be suggested that the AO contain provisions for requesting additional data without jeopardizing the proposers' position relative to selection. NASA Handbook 8030.6 states that an AO should specify the latest deadline for receipt of proposals and that a minimum of 90 days is required between mailing the AO and the deadline. It is suggested that the commercial AO state that subsequent data may be requested after receipt of the AO but that insufficient compliance with the AO could result in rejection without requesting additional data.

Figure 2 indicates a provision for consultation during Step 1. For the first evaluation step it is considered that NASA has the expertise required except for that associated with the market evaluation part of the proposal. It is important to minimize

the amount of outside NASA consultation, therefore, it is recommended that, during Step 1A, only those proposals that pass all criteria (other than market evaluation) be referred for consultation on market evaluation.

Unsolicited proposals received by NASA should be screened for completeness but not necessarily against the requirements of a formal AO. Those unsolicited proposals that show promise and uniqueness should be injected into the evaluation process beginning at Step 2 (after initial screening).

#### Step 2--Determine Technical Feasibility/Technology Impact

Step 2 in the evaluation process is designed to determine the technical feasibility and risk of the proposal (solicited or unsolicited) and the impact of the technology if developed toward commercialization. In this step NASA, possibly with the assistance of outside experts, will attempt to determine (a) the technical understanding, competence and reliability of the proposer, (b) the research that supports the proposal and (c) the probable impact of the proposed concept if the development is successful.

This evaluation will be different from that suggested in NHB 8030.6 in that there may not be clearly recognized peer groups for evaluating the proposals. In fact, the "recognized" peers may be competitors of the proposer and the proposed technical approach may involve or reflect techniques, processes, and facilities with which industry is more familiar than NASA.

Another difference in the evaluation of Step 2 is the degree of understanding of the idea proposed. The principle underlying the scientific AOs is that NASA has determined, through internal and external advice, that certain experiments warrant investigation because theory indicates they will be promising from a research standpoint. It has not been an overriding goal that the research have an immediate commercial payoff but rather that it is sound science. This is not the case with commercially oriented materials processing experiments/developments in space. The proposals selected must demonstrate that they have technical potential value for:

- Early applicability
- Economic impact
- Benefits to the general welfare of the nation.

Since commercial materials processing in space is in its infancy, one must not overlook the fact that NASA has sponsored much of the fundamental research and, therefore, should be in a prime position to evaluate proposals for the commercial development of processes or products. However, it should also be considered that the entrepreneurs in this country have established a good record for innovative ideas that "experts" thought were of little value--commercially. To date, several organizations have taken NASA research and turned it into what they consider viable commercial opportunities. Thus, one element in the evaluation process should be: why did the proposer spend time and resources responding to the AO? A related element is whether there is a clear, overriding justification to develop the technology in space as compared to accomplishing it on the ground. These questions in addition to "will the proposed process function as envisioned?" must be answered by those evaluators most familiar with the associated science.

An important technical element is the understanding of the interrelationship, if any, between ground-based and space-based developments. This will be particularly important in selecting those processes that may result in major advances to ground-based technologies.

NHB 8030.6 provides a list of general criteria that should be carried over to the commercial evaluation process. In addition to the general criteria, there are specific commercially oriented criteria that should be considered.

- The technology requires space.
- The technology does or does not have interrelationships with ground-based developments.

An additional specific criterion is:

- The influence the technology will have on the national well being.
  - Health
  - National Security
  - Economy.



Although this last criterion (technology impact) is not directly connected to technical feasibility, it is our opinion that the technical evaluators will be the most qualified to match the proposal with this criterion, particularly in the areas of health and national security.

These criterion will require that the proposers provide NASA with their evaluation of the specific commercial uses of the technology. It will also require that NASA obtain independent assessments of the technology use. These independent assessments can be obtained within NASA, through the use of other government agency experts and from private organizations. For the areas cited above (health, national security and economic impact), it should be possible to perform the independent assessment entirely within the government. This may require that NASA contact other government organizations, e.g., NIH, Departments of Commerce, Labor, Interior, etc., and discuss the overall program with them so that they will be in a position to cooperate.

From the above, it can be seen that another criterion should be to:

- Evaluate NASA's role in the proposed technology development.

The rationale for this criterion is twofold. First, the proposed technology development may not be within NASA's charter, e.g., defense-related technology. Second, but perhaps more important, there may be opportunity for cooperatively funding the technology development phase, e.g., a biological process proposal may be a potential for joint sponsorship with NIH or it may be possible to refer relevant proposals to DoD for possible sponsorship.

### Step 3--Determine Capability to Carry Out Proposal

Cost will be a major criterion in selecting proposals. NHB 8030.6 requires the submission of cost, technical, and management plans. Within the cost plan, a funding obligation plan is not mandatory. In reviewing these requirements, it is our opinion that they are applicable to the commercially oriented proposals for the technology development phase (Phase I, Figure A). One recommended change would be to require a funding obligation plan (in the cost plan) from all proposers (NHB 8030.6, pp. 41, B.3.). The rationale for this change is that the technology development effort should

be sufficiently known and defined, i.e., the research is known and the technology should be understood. The obligation plan should show both NASA funding and the proposer's funding (in cases of proposed cost sharing).

Procurement regulations require that a government agency not enter into a contract that will result in financial damage to the contractor. Therefore, if the contractor does not have the financial ability to comply with the contract, then the government should not force a situation that will compromise the contractor's financial posture. Step 3 in the evaluation approach encompasses the evaluation of the proposer's technical plan, management plan and cost plan, and should not be any different for commercial proposals than it is currently for scientific experiments. NHB 8030.6 (par. 400 1.e) covers this aspect of the evaluation. The principal difference in evaluating commercial proposals may be seen in the large number of responses from individuals who may not have institutional relationships. For outstanding proposals that do come from individuals without institutional relationships, NASA should work out a mechanism for assisting these proposers, e.g., temporary employment and facilities support.

#### Step 4--Estimate Commercial Value

The projected commercial value of the proposed technology development is basic to the evaluation process. The intent of NASA, in sponsoring commercially oriented materials processing experiments/demonstrations, is to arrive at a point where the commercial activity is available in the marketplace. NHB 8030.6 covers a similar area for evaluating scientific/applications experiments but the task of evaluating these activities is to determine if the research is relevant, desirable and has a probability of acquiring positive results. For the commercial experiments, the evaluation should estimate the commercial value for the proposed product or process; how the commercialization will be effected, probability of the commercialization, and when will it be available on the commercial market. To accomplish this evaluation step NASA and/or the proposer will need a good analysis of the commercial market projection for the particular experiment/demonstration.

As noted previously, total cost must be a criterion for selecting proposals. NHB 8030.6 requires the submission of a cost plan for the proposed development, and this is most appropriate for the technology development phase. In addition to the cost plan, NASA should also require an estimate of the cost for commercial development requirements (Phase II of Figure 1). An estimate of NASA funding requirements as compared to how much industry or venture capital can reasonably be expected to contribute should be identified.

In general, NASA will be faced with assessing the advisability and risk of funding technology developments which could result in a product or service which could have a significant market in the commercial world. The full commercialization of a specific proposed MPS technology development could take several years. For NASA to evaluate, and perhaps select, a commercially oriented proposal, data and projections on the following questions and issues will have to be addressed:

- Will the proposed experiment or demonstration lead to a requirement for additional research, development and demonstrations?
- What is the remaining technical development sequence required and what is the risk involved?
- At what point in the commercial development of full commercialization phases can it be reasonably assumed that venture capital will be invested?
- How long, and at what levels, is government funding required?
- Is there evidence of end-user need or interest?
- Is the proposed technology development of sufficient commercial importance that it could serve as the basis for a new product line, a new company or significantly complement an existing, known product line?
- Will the underlying technology lead to follow-on products or services?
- Does the technology lead to solving or minimizing a national need or industry problem that would substantiate or support a commercial product?

- Does the contemplated commercialization plan depend upon a single narrow product line, or a comparatively broad one?
- Will the potential commercial market be as free as possible from present or potential government regulations that might limit its growth potential or delay revenues?
- Will the product depend upon a broad customer interest (desirably) or will it depend upon one or a few customers, including the government and, thereby, in effect be controlled by those customers?
- Will the projected commercial product be in a favorable market position resulting from a strong proprietary advantage?
- Is the process/product produced in ground-based facilities today? at what price?
- If so, how will space-based technology contribute to current technology? higher quality? lower price?

In addition to evaluating the commercial value and commercialization aspects of the proposed MPS technology development, NASA should further evaluate the projected use of space and use of the STS associated with the proposal. The following issues should be addressed:

- Can the total ground-space-ground based process be defined as that to be associated with the final, routine manufacturing process for the proposed development?
- What spacecraft or payload configuration is envisioned to implement the space-based portion of the product's commercialization? free flyer? pallet? Spacelab?
- Is there a basis for estimating reimbursement to NASA for use of the STS?
- How many STS flights over what period of time will be required to arrive at a marketable process or products?  
What is the projected follow-on, routine use of STS?

Answers to these questions and the NASA evaluation of the proposers cost plan and projected commercialization costs should provide NASA with insight into whether the proposer has fully thought through the commercial development and, also, whether the market evaluation appears reasonable.

It was mentioned, in the preceding section of this report, that market evaluation is, in most cases, a question of judgment. There are, however, organizations that specialize in the assessment of future markets for technical innovations. For example, the Battelle Development Corporation (BDC) was specifically established to provide this kind of analysis to the Battelle Memorial Institute on patented inventions. BDC screens hundreds of patents and patentable ideas each year to determine the marketability of the technology and to decide if they should pursue the patent as a commercial venture. Appendix B of this report contains information on the BDC process and techniques used for evaluating ideas and inventions relative to their commercial value. In reality, this process is that of understanding the commercial value and the process of commercialization as shown in Figure 1.

The criterion for evaluating proposals for commercial value involves an assessment of the proposer's understanding of the commercialization process; for example, this must involve an evaluation of the proposer's appreciation that the commercial development phase requires a sound understanding of material flow processes and/or manufacturing techniques that will result in a pilot or pre-production development that demonstrates the capability to produce the process/product in a commercially competitive environment--whether in terms of quality, price or both.

If the proposer understands these functions and also has the capability to utilize the results, i.e., to produce and market, then that proposer could be used for all three phases of commercialization (Figure 1). For most initial proposals this prospect may be unlikely for several reasons, because proposers are likely to fall in one of the following classes:

- Proposer is in the commercial business but is inexperienced in space research.
- Proposer is an individual entrepreneur who has no commercial experience.
- Proposer is an experienced developer but restricted in terms of commercial involvement.

Therefore, the criteria for understanding the commercialization process should be weighted to achieve the greatest potential for success from all the various proposers.

This indicates a need to consider the potential for teaming. The teaming issue for commercial ventures will be quite different from that experienced for science or application experiments because of the proprietary and profit-making aspects of the commercial developments.

It is expected that NASA will include information in the commercial AO, or elsewhere, on the types of MPS experiments conducted and NASA's estimate of their potential commercial opportunities. It is assumed that this information will trigger proposers to expend effort to determine how they can capitalize on the experimental data for commercial ventures. It is to be expected that this expended effort will be considered, by the proposers, as their initial investment in the development and, in many instances, they will consider their response to be proprietary in nature. Since it is illegal for government employees to divulge proprietary information, it would appear difficult for the government to become a broker for teaming arrangements even though that would enhance the opportunity for success of the development. On the other hand, one of the primary reasons for government sponsorship of commercially oriented MPS developments is to encourage creative and innovative uses of materials processing phenomena for commercial/general public use. The problem is that of finding means by which the government can protect proposers' rights and still achieve this programmatic purpose.

NHB 8030.6, as stated earlier, has a provision that allows NASA to offer a principal scientific investigator the opportunity to accept or decline teaming with other investigators. Although the legal wording should be carefully approached, it would appear that a similar mechanism could be worked out for commercial developments. In doing this, the proposers must be assured that their rights will be protected and that the government will not discuss their proposals with any potential competitor without their permission and then only after agreement is reached as to what the proposers' rights will be if teaming were involved.

#### Step 5--Final Evaluation/Rank Proposals

Step 5 is the process of developing an orderly approach that will allow a final evaluation and selection of proposals. In comparing Step 5

to the process outlined in NHB 8030.6, there are three differences that are unique to the commercial proposal selection process. They are:

- The potential market for the commercial experiment/development
- The legal requirements placed on NASA by the proposer (patent and proprietary)
- The proposer's understanding of commercialization.

However, as has been noted earlier, the weight for technical feasibility should be of greater consideration than the judgmental estimate of commercial value and marketability.

In this step, the evaluations developed in Steps 2, 3 and 4 must be integrated and weighed to determine the desirability of funding each proposal and to permit a ranking of all proposals being considered. After due consideration of funding available, the actual final selection of proposals for funding will be made.

In general terms, this type of selection is made many times every day in the commercial world. Every time venture capital is sought for an innovation, the manager of venture capital must decide how likely success is, and how much he will recover if success is achieved, and how all that relates to other possible uses of the same capital funds.

In evaluating commercially oriented proposals, NASA will be somewhat in the position of a venture capital manager, and somewhat the same considerations would apply as in the commercial world. There are important differences, however. NASA is not seeking a financial return on the investment, but rather a return in terms of the national welfare. This has some aspects which cannot be quantified, but some aspects can be.

For example, if some new process will provide a cheaper way of producing some existing product, and if extent of application of that new process is known, it is a relatively straightforward matter to compute the increment in Gross National Product brought about by that change. Unless that increment bears some reasonable relation to the cost of developing the new process, it would be an undesirable investment.

However, in order to make this sort of computation, it is necessary to hypothesize the degree of market penetration for the new product. This is also conditioned by the probability of technical and market success.

These quantities are frequently impossible to quantify with any accuracy. It is necessary to rely on opinion of those who understand the technology and the markets in question. In the case of technology, the estimation of success is something which NASA has done many times. As for markets, it will be necessary to rely on outside expertise.

Those most familiar with market forecasting are quick to admit that it is a very uncertain enterprise. There are many examples of serious errors made by highly knowledgeable people in estimating commercial markets. Nonetheless, venture capital managers do make decisions. They collect the best opinion they can get, and act on proposals.

In the evaluation process, it is suggested that the data from Steps 2, 3 and 4 be integrated into a computation of the expected net present value in the U.S. market based on pessimistic, nominal and optimistic assessments of probability of technical success and market size.

These numbers could be used for general ranking, but there are many other factors to be considered. Possible follow-ons to the proposed development, the detailed nature of the estimated effect on the economy, and the contribution to non-economic goals should be considered. In the final analysis, selection will be an exercise in judgment, but the type of data which has been suggested for the preceding steps should make it as informed a judgment as the present state of knowledge will allow.

#### PART B - SELECTION CRITERIA FOR COMMERCIAL PROPOSAL EVALUATORS

This section of the report covers Part B of the Statement of Work which requires the contractor to:

- Develop criteria for use by NASA in selecting qualified individuals experienced in entrepreneurial activity who can review proposals and make recommendations to NASA on their commercial merits considering such factors as: avoidance of conflict of interest, protection of confidentiality and desire to encourage, not inhibit, creativity.



NHB 8030.6, paragraph 402, covers guidelines for selecting qualified individuals (and conditions of selection) for science and technology mission proposal evaluation. In our opinion, this section is also pertinent to selecting individuals qualified to evaluate commercial proposals. The principles related to the avoidance of conflicts of interest and the protection of confidentiality are no different for evaluating either science proposals or proposals leading to possible commercial ventures.

Reference is again made to Figure 1. As stated in the preceding section of this report, commercialization requires three phases: technology development, commercial development and full commercialization. It has been stated earlier that, for a commercially oriented program, the proposals will be emphasizing the technology development phase. NASA will need qualified individuals (some probably non-government) for evaluation of the technology development being proposed as well as the proposer's projections and understanding of the commercial development and full commercialization phases. The influence each individual exercises over selection should be directly related to their knowledge of a particular phase of commercialization.

For the technology development phase, it would appear that consultation with the NASA or non-government principal investigator who conducted the research on the process is a requirement. If there was an instrument or space research facility developer, different from the research P.I., they should also be a required consultant (assuming they are not a proposer themselves). NASA personnel, who were involved with the P.I. in the research, will be key consultants for several aspects of the technology development phase, e.g., technical, cost, performance, etc.

Beyond these "required" consultants for evaluation of the technology development phase being proposed, there are individuals available in other government agencies, industry, applied research institutions and associations. NASA needs to identify an approach to locating these qualified individuals.

The proposal, itself, will indicate the area of applicable commercial development. This, in turn, will indicate which government agencies might have cognizance over the particular technology area (e.g., NIH) or

which agency might have related technical expertise (e.g., Naval Research Laboratory or National Bureau of Standards). It should be recognized that many individuals in government have come from industry and, therefore, in addition to their knowledge of government activities and operations, they can provide considerable insight into the process of commercial venture development. Thus, one criterion for selecting qualified individuals should be based on their potential for combined in-house government operations and relevant commercial/industry development and marketing expertise.

In searching for these government experts without wasting an inordinate amount of time, NASA may need assistance from the Office of Management and Budget (OMB) in determining where, in the government, budgets are allocated for the particular proposal areas. In fact, NASA should, as a part of their budget approval process for the commercial materials processing program, lay the foundation for such inquiries and cooperation from OMB and, through the OMB, cooperation from other government organizations.

The potential scope of the commercial MPS program is such that NASA will need to have a broad base of available outside consultants to assist in the evaluation process on an as-needed basis. Besides the normal relevant knowledge qualifications, one criterion for selecting these consultants must be a requirement that they not be in competition with the proposer (either in terms of business involvement or as a proposer for available resources at that time). Another requirement is that the consultants (who come from outside government) must be paid by the government so that they become special government employees and, therefore, subject to the same laws that govern government employees regarding proprietary data, trade secrets, etc.

NHB 8030.6 states that being involved through institutional associations, per se, does not, in itself, constitute qualification for selection. This policy was found to be sound in selecting individuals for the evaluation of either scientific or technical proposals and should continue for the technology assessment portion of the commercial proposals. It should, however, be modified for the value assessment in evaluating commercial proposals. To obtain a valid commercial value assessment will

require the combined opinions of several experts. For example, this evaluation process could require an economic evaluation, market analysis, financial analysis, legal analyses (including patentability, export controls, etc.). There are institutional associations that have credentials for conducting this type of assessment. The criterion for selecting such organizations should be the same as that for selecting individuals, i.e., the institutional association (and the individuals involved) must not be involved with any proposal which would be competitive for the resources involved.

Since it will be essential to have individuals from identifiable industries as consultants for the technology evaluation it will, as stated earlier, be important that they be handled as special government employees for the period of consultation. After their consultation they should be debriefed to inform them of their responsibility not to divulge the information they have obtained from the evaluation.

In addition to individuals, profit and non-profit organizations that have the required experience and the institutional associations representing specific industrial communities should not be overlooked, e.g., the Pharmaceutical Association Manufacturers and the Electronic Industries Association, as compared to a broader group such as the National Association of Manufacturers. Many of these associations not only have competent full time staffs, but they have knowledge of experts who are in their membership. In addition to providing names for evaluation, they could be valuable sources for developing the lists for AO mailings.

The major industrial banks would appear to be a good source for assessing the business potential and risk of proposals. They may also be a source for individuals or organizations experienced in entrepreneurial activity.

#### PROPOSER'S PROPRIETARY RIGHTS

Figure 2 contains one other element that is considered important to the evaluation process, i.e., the proprietary rights of the proposers. As shown in Figure 2, it is suggested that all proposals be carried through

the evaluation process (Steps 1-5) as proposer proprietary data and only after final selection and contract award (including defined patent and proprietary rights) should the proposal be made public. Those proposals not accepted should be returned to the proposer along with any data furnished in support of the proposal. This represents, to NASA, a change in the handling of proposals after receipt and during proposal evaluations and a significant change in the return of non-selected proposals. However, this will avoid any compromising of a proposer's trade secrets and proprietary data included in their proposal. Subsequent to the award of a contract, the selected proposer must accept the handling of such information which a government-funded contract dictates.

NHE 8030.6 references 18 USC 1905 which prohibits any officer or employee (including special employees) of the United States from disclosing or divulging certain kinds of business confidential and trade secret information unless authorized by law. Within NASA, employees must demonstrate a need to know for a NASA purpose in order to obtain this type of information.

This is the legally established criterion for handling proprietary data, business confidential and trade secrets. In our opinion, the law is clear in that any employee of the government can be prosecuted for violating its provisions. Why then has there been so much debate over the ability of the government to protect the rights of commercial ventures? Probably it results from commercial organizations having little confidence in the government's ability or dedication to enforce the Code and in governmental procedures for handling the data. Even though NASA has a good record for not disclosing sensitive data, the commercial community is still very apprehensive about the information they must supply the agency. To assure success of the commercial MPS activity through the submission of the most innovative and economically sound ideas, NASA should require that all sensitive data be labeled (covered) and handled in the same manner as secret level classified documents. People both in and out of government understand the classified document system and industry, in particular, should have assurance that their data will be protected.

Since NASA is the sponsor of the program discussed in this report, it is unlikely that NASA will be able to afford very many, if any, parallel

approaches on commercial technology development. Therefore, the selection process will usually result in a single proposer or a team of proposers selected for a particular development contract. NASA will be required to announce the awards and, at least to some extent, provide the purpose of the mission (contract). This fact should be made clear in the AO.

The proprietary rights and trade secrets issue becomes much more critical when the commercial venture is privately funded. In this case, the government does not make a selection (except for compliance with STS operational rules). However, the parenthetical statement may cause a problem for the commercial community. NASA has indicated that they will require considerable information on the development in order to assess its safety, integration requirements, etc.

Since the NASA-sponsored commercial program is designed to eventually encourage privately funded commercial ventures, it is important that the issue of protecting trade secrets, etc., be reviewed by NASA from the viewpoint of how they intend to enforce the present law. Such intentions should be included in the AO (perhaps as an addendum).

In order to maintain a proper perspective, it must be recognized that as long as there are human beings operating the system, there will be violations, e.g., the recent top secret satellite data from the CIA and the leak of the Sears five-year business plan.

The point is, it would be unreasonable for the commercial organizations to expect a 100 percent guarantee that their data will not be divulged. What they should expect is appropriate punishment for anyone who is caught.

The situation becomes more complex after the government accepts a proposal and negotiates a contract using government funds. Such contracts are available to the public. However, the Code of Federal Regulations Part 1206.300(b)(4) [implementation of the Freedom of Information Act (FOIA)] exempts "trade secrets and commercial or financial information obtained from a person and privileged or confidential", from public disclosure. On the other hand, Part 1206.301(b) of the code states: "Nothing in this Part 1206 shall be construed as authority to withhold information from Congress". Congress recognizes the potential for disclosure of trade

secrets, proprietary data, etc., when dealing with commercially-oriented uses of space. A bill, introduced by Congressman Don Fuqua, to establish a Space Industrialization Corporation, contains a section that deals with this matter. It states: "(1) in order to encourage proposals of the highest quality on the frontiers of human knowledge and technological innovation, from broad and diverse industries and businesses which in many cases are highly competitive, the corporation shall be exempt from the provisions of Section 552 of Title 5, United States Code (FOIA), with respect to information relating to applications, proposals, management plans, or financial or assistance agreements under this act".

This bill has not passed Congress but, since it is recognized that the disclosure of data to anyone (other than those with a valid need-to-know) can inhibit the process of commercial involvement in space developments, there should be congressional support for exemption of NASA from reporting sensitive commercial data to Congress or anyone else not directly connected with the commercial project. It is recognized that NASA has developed legal statements to be included in STS launch agreements that are designed to assure users that their rights will be protected. These assurances will not carry much weight if a chairman or ranking member of a Congressional committee demands information under the presently written FOIA.

#### SUMMARY

##### Overall

NASA must assume that the initiation of the commercially-oriented materials processing program will attract broad and diverse interest. Therefore, it is important to reemphasize the need for quick initial screening of all proposals received by NASA. The screening should consider, in a judgmental sense, the following:

- Is the proposal coherent?
- Is there something similar already on the market?
- Is the process/product technically feasible?
- Can NASA afford the development funds?
- Is it clear what the NASA follow-on funding requirements will be and when industry or venture capital will take over support of the commercial development?
- Does the development fill a market need?
- Is the proposed process/product acceptable for NASA sponsorship?
- Is the proposed development patentable?
  - Do patents already exist?
  - Is there infringement potential?

After the proposal has passed the initial screening, NASA should carry out the in-depth technical analysis (Step 2, Figure 2). If the proposal passes the technical analysis then NASA should determine the market potential. This should include:

- What kind of market?
  - industrial
  - consumer
  - service
- Scope of market?
  - National
  - International (and can it be exported?)
- Potential for more than one field of application.

The key question in the market assessment is: Who needs it?

Following the market assessment, NASA should carry out a patent search. This search is needed to assure NASA that they are not sponsoring a development that infringes on someone else's patent.

In carrying out the activity needed to evaluate a proposal, NASA will need to consult with industry, institutions and associations. There are several organizations that have expertise in such evaluations. Among these are:

Battelle Development Corporation

A.D. Little, Inc.  
Research Corp.  
National Patents  
National Science Foundation Workshops

The Federal Trade Commission has a list of such organizations. As indicated above, entry into support of commercial proposals may lead to NASA turning down proposals for reasons never before used for NASA research proposal rejections. They should be prepared to handle this new situation. This aspect of the commercially oriented proposal rejection could have an impact on the current debriefing approaches and procedures now used for those proposals rejected under the current AO system.

NASA will be involved in evaluating proposals which have value with which NASA may not be familiar and the follow-on, i.e., the commercial development and full commercialization phases will rely upon decreasing NASA involvement and increasing industry involvement. This is the situation which NASA must evaluate with each proposal. This not only places a special emphasis on the need for non-NASA evaluation support, but it also results in a much greater need to require insight and future projections from the proposer. It should also be noted that the AO itself can help NASA to obtain the data required and to optimize use of the data received to facilitate their evaluation of the commercial value and commercialization plans. The AO can also be a very effective means of communicating, to potential proposers, the guidelines and policy on proprietary data, confidentiality of research and trade secrets.

#### PART A

The recommendations for modifying the current proposal evaluation approach and for new criteria for evaluating commercially oriented MPS proposals submitted to NASA (for NASA Funding) are summarized below:

- The commercialization process (Figure 1) will result in a gradual reduction of NASA control over the proposed process/product development program.



- The established guidelines (NHB 8030.6) have considerable significance and are generally directly applicable for the commercial evaluation process.
- There are requirements unique to the commercial evaluation process that are developed in the discussion of Figure 2.

They are:

Step 1 - Assess AO Compliance

- Provide greater flexibility for discussions with proposers.
- Additional data requests should not jeopardize proposers' selection position, but
- proposers must be informed that failure to comply with the AO could result in rejection of proposal.

Step 2 - Determine Technical Feasibility/Technology Impact

- Utilize known experts, e.g., research P.I. and research instrument contractor personnel.
- Industrial peers should be used as consultants.
- Assuring of interrelationship between ground based/space based developments.
- Evaluate technology impact, if developed.
- Assure understanding of interrelationship between ground-based/space based developments.
- Each proposer must evaluate specific commercial uses of proposed technology developments.
- Obtain independent assessments of technology development and use.
- Establish contacts with organizations (other government agencies, research and development institutes, industrial banks and industry) to assist in areas such as: economic impact, health and national security.
- Evaluate NASA's role relative to the technology development proposed, e.g., defense related developments.

Step 3 - Determine Capability to Carry Out Proposal

- Evaluate potential for financial damage to individual entrepreneurs, small business, etc.
- Anticipate high number of responses from individuals not associated with an institution.

Step 4 - Estimate Commercial Value

- Evaluate specifically what the commercial value is:
  - o How commercialization will be implemented
  - o Timing for process/product to reach the market
  - o Require good technology development cost data; estimated cost and pricing information on the process/product
  - o Require funding obligation plan from all proposers for the technology development phase
  - o Potential for development occurring without the use of space
  - o Evaluate the competitive position of the proposed technology development
  - o Price of any competitive ground-based process/product
  - o Contribution of space-based technology, e.g., higher quality--lower price
  - o STS flights required over time period to arrive at and continue a marketable process/product
  - o Price required for process/product to achieve reasonable return on investment
- Use recognized institutions for commercial value assessments:
  - o Non-profit research organizations
  - o Industry or trade associations such as PMA and EIA
  - o Industries identified with discipline but not in competition for resources involved
  - o Industrial banks
- Evaluate potential for teaming:
  - o Consent of proposer required

- o Protection of proprietary rights, trade secrets, etc., must be assured through written agreements and with data being handled as with a classified document.

#### Step 5 - Final Evaluation/Ranking Proposals

Uniquely different from science AO because NASA must rank:

- o The potential market for the commercial development
- o The requirements placed on NASA by the proposer; e.g., patent, proprietary data, trade secrets, business secrets, etc., - can or cannot NASA comply with requirements which would be involved
- o The proposer's understanding of commercialization.

A general requirement is for NASA to maintain the proposals as proprietary data belonging to the proposer. The AO should clearly state that the proposer should mark his data, i.e., proprietary, business sensitive, etc., and, if so marked, NASA will give the data the same protection as classified data.

#### PART B

- NASA will need qualified individuals to evaluate the three phases of commercial development (Figure 1).
  - Use principal investigator from prior research activity.
  - Use research instrument contractor - if not also a proposer.
  - Use NASA personnel who worked on prior research.
  - Proposal will suggest other sources for individuals by virtue of the area proposed for development:
    - o Government agency personnel whose agency has a mission related to the proposed development, e.g., NIH, DOD, NRL, NBS, etc.
    - o Paid consultants from industry who are identified with the area of proposed development

- Locate consultants through
  - o Trade associations
  - o Non-profit research institutes
  - o Industrial banking institutions.
- Consultants must be paid by the government in order to assure that they must comply with government regulations on handling the sensitive data furnished by the program.
- Consultants must be briefed and debriefed on their legal obligations regarding the handling of sensitive data.

In conducting this study, the issues, approach and recommended criteria have been discussed in the context of NASA-issued Announcements of Opportunity and NASA-funded technology developments for commercially-oriented materials processing experiments/demonstrations. Other general comments applicable to the commercial AO are: (1) there is a greater necessity for the inclusion of qualifiers in the Announcement of Opportunity itself, e.g., areas unacceptable for NASA sponsorship, specifics on handling proprietary data, etc., and (2) there is a requirement to place more of a burden on the proposer to project the commercial value and follow-on activities which might be involved.

#### RECOMMENDATIONS

It should be recognized by NASA that the private commercial sector will view NASA-funded phases of commercialization much differently than they will developments which they pursue entirely with their own funds. The principal difference will be the extent of disclosure to which they will agree. This area of cooperative funding and/or full private sector funding was not a part of this task; however, NASA is urged to pursue the issues involved because they will not be easy for the government to deal with. It is recommended that NASA initiate a study that will expose the many concerns and issues of industry in the area of commercialization with private funding involved.

Additional recommendations are:

- (1) NASA should prepare a draft (sample) Announcement of Opportunity incorporating the conditions covered in this report, and obtain industry comments on the draft.
- (2) NASA should develop new guidelines for handling the commercially oriented materials processing Announcement of Opportunity for experiments/demonstrations based on the data in this report and comments obtained from the above recommendation.

**NHB 8030.6**

**JULY 1974**

**EDITION**

**APPENDIX A**



**GUIDELINES  
FOR  
ACQUISITION  
OF  
INVESTIGATIONS**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

**WASHINGTON, D. C. 20546**

## NASA ACQUISITION OF INVESTIGATIONS

### PREFACE

July 19, 1974

From its beginning, the NASA has provided opportunities for qualified people in the NASA, other Government agencies, colleges and universities, private industry, and foreign countries to participate in developing and carrying out its responsibilities in aeronautical and space activities. The NASA has treated itself as a part of the scientific and technical community and has encouraged this community to bring to bear its expertise in developing investigatory objectives, selecting the investigations to carry out, participating in the resulting missions, analyzing the data obtained, and publishing the results.

Success of our programs in aeronautics and space, in a large measure, can be attributed to the ability of the NASA to harness the ideas, knowledge, and technical abilities of the investigators inside and outside of the NASA. Success has also been dependent on the effective development of equipment required for investigations. In the area of space applications, program success also depends upon the support of actual and potential users of space related systems, and upon how well the NASA understands their operations and programmatic requirements.

The acquisition of investigations process covered by this Handbook allows the continuation of our successful cooperative endeavors with the scientific, technological and applications user communities, and, at the same time, provides standards requiring greater attention to the planning and management of investigations. Also, this Handbook emphasizes the responsibilities of line management and, as appropriate, the selected investigators in the acquisition of equipment necessary for the investigation. This Handbook should assure uniform procedures and equitable treatment in the evaluation and selection of investigators and the acquisition of investigative equipment.

The Handbook provides general and specific guidance to all the NASA personnel engaged in the solicitation, evaluation, and selection of investigations. Its provisions are effective immediately.

This Handbook is available to the public from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

NMI 7100.1 and NHB 8030.1A are canceled.



James C. Fletcher  
Administrator

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# **GUIDELINES FOR ACQUISITION OF INVESTIGATIONS**

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## **CHAPTER 1: THE INVESTIGATION ACQUISITION SYSTEM**

### **100 GENERAL**

Experience has shown that the best space research results when active space research investigators themselves participate in the selection of investigations. The investigation acquisition system provides the mechanism for encouraging the participation of investigators and selecting the investigations which contribute most effectively to the advancement of the NASA's scientific and technological objectives. It is a system separate and distinct from the ordinary acquisition process but requiring the same vigorous management and discipline to assure compliance with statutory requirements and elementary considerations of equitable treatment.

### **101 KEY FEATURES OF THE SYSTEM**

1. Utilization of the system commences with the Program Associate Administrator's determination that the investigation acquisition process is appropriate and applicable for a program under consideration. There follows a broadly disseminated Announcement of Opportunity to the interested community. This solicitation does not in the general case specify the investigations to be proposed but rather solicits investigative ideas which contribute to broad objectives. The proposals received are distinctive and innovative. Not all can be accepted, and the dissimilar proposals are subjected to a competitive evaluation process. The evaluation for merit is normally made by experts in the specific fields represented by the proposals and care taken to avoid conflicts of interest. These peer evaluators may be from the NASA, other government agencies, universities or the commercial sector. Along with or subsequent to the evaluation for merit, the other factors of the proposals such as engineering, cost and integration aspects are reviewed by specialists in those areas. The evaluation conclusions as well as considerations of budget and other factors are used by program managers to formulate an optimum payload for the missions under consideration. A steering committee serving as staff to the Program Associate Administrator reviews the proposed payload or program of investigation, the iterative process and the selection recommendations. The steering committee serves as a forum where different interests such as flight program, discipline management and administration can be weighed and reconciled. The Program Associate Administrator selects the investigations and the investigators who shall participate in the program. Once selected, an investigator is assigned appropriate key responsibilities relating to his investigation through a contract with his institution. In the case of foreign investigators, these responsibilities will usually be outlined in an agreement between NASA and the sponsoring governmental agency in the investigator's country.

2. The following major steps should be followed in each case where the determination is made to utilize the investigation acquisition system:
  - a. An Announcement of Opportunity shall be signed by the appropriate Program Associate Administrator and shall be widely distributed to the scientific, technological and applications user communities.
  - b. An evaluation team shall be appointed including recognized peers of the investigators to review the proposals.
  - c. A project office will be assigned to assess the engineering, cost, integration and management aspects of the proposals.
  - d. A program directorate will be responsible to recommend a payload or program of investigations consistent with mission or program objectives, and cost and schedule constraints.
  - e. A steering committee appointed by the appropriate Program Associate Administrator shall review the proposed investigations for relevance and merit and will assure compliance with the system as described in this Handbook.
  - f. Selections shall be made by the appropriate Program Associate Administrator.

## 102 MANAGEMENT RESPONSIBILITIES

1. Program Associate Administrators are responsible for overseeing the process and for making key decisions essential to the process including:
  - a. Determination to use the system.
  - b. Appointment of the steering committee.
  - c. Establishment of advisory subcommittees (peer groups) as prescribed in NMI 1156.4D,
  - d. Issuance of the Announcement of Opportunity.
  - e. Selection of investigations and investigators, determination of need of a definition phase, determination of the role of the investigator with regard to providing essential investigation hardware and services.
2. The Program Office is also responsible for coordinating Announcements of Opportunities with the Office of International Affairs and the Office of University Affairs prior to issuance. Attention is directed to NPD 1362.1B "Initiation and Development of International Participation and Cooperation in Aeronautical and Space Programs" and NPD 1360.1 "Coordination of Research Concerning Foreign Areas."
3. Exercise of these responsibilities will require the professional assistance of experts in several functional, programmatic and technical disciplines. The Program Associate Administrator should call upon those experts at appropriate times throughout operation of the process. The remaining chapters of this Handbook will discuss the exercise of the above responsibilities in greater detail.

## **CHAPTER 2: APPLICABILITY OF THE PROCESS**

### **200 GENERAL**

The system used for acquisition of investigations is separate and distinct from the Agency procedures for procurement of known requirements of hardware and services. A decision to use the special acquisition process will be based on a considered determination, in accordance with the general guidance in this chapter, that it is the most suitable to meet program needs. The decision-making official will consider the criteria for use of the system, its applicability to the program under consideration and any benefits from use of the system. The project plan or other program or project documentation should discuss the proposed mode of investigation selection.

### **201 CRITERIA FOR DETERMINING APPLICABILITY**

1. The decision to utilize the investigations acquisition process as an alternative to the normal planning and acquisition process of the Agency can only be made after consideration of the special conditions which are requisite to its use. All of the following conditions should exist before deciding that the system is appropriate and applicable:
  - (a) It is not possible to predetermine a requirement. Rather, the NASA has a general objective which can be furthered through unique, novel experimental approaches. To develop such novel approaches, the NASA wishes to draw upon the broadest reservoir of ideas that can be made available.
  - (b) Choices must be made among competing dissimilar ideas, because the specific opportunity is constrained by boundaries such as the weight, power, and funds available.
  - (c) Individual participation of an investigator is essential to exploitation of the opportunity.
2. The investigations acquisition process should not be used when any of the following characteristics are present:
  - (a) The requiring office can define a requirement sufficiently to allow for normal procurement. This includes requirements that can be stated as design or performance specifications, including requirements for the use of known technology and hardware, and requirements for continuation of existing tasks;
  - (b) The opportunity is not so limited from a cost, time or other point of view that a special competitive structure is required for choosing among dissimilar proposals;

- (c) The program is extremely complex, requiring specialized integration, coordination, or other special handling, or extending over a lengthy period wherein individual participation is not essential;
- (d) It is not possible or considered essential to the program to follow the critical steps of the special investigations acquisition process.

## 202 PROGRAMS AND ACTIVITIES WHERE USE MAY BE CONSIDERED

### 1. GENERAL

The investigation acquisition process is most suitable for payload selection in missions aimed at exploration and composed of several unique sensors or instruments but it has been used successfully and advantageously in several types of opportunity. Each program is unique and the opportunities for participation in investigative effort will necessarily vary from program to program. Similarly, program implementation plans may provide opportunities for participation but may not meet the conditions necessary for use of the special investigations acquisition process. In those latter cases, the normal procurement procedures will be followed to meet the program needs. Because of the differences in programs, only general standards can be given to guide the decision of whether or not to use the alternate acquisition process. There follows a discussion of several types of programs, the opportunities they offer and comment on the suitability of the special process.

### 2. EXPLORATION AND SPACE RESEARCH FLIGHTS

a. *Examples.* Pioneers, Mariners, Small Astronomy Satellite, Nimbus F, Apollo Telescope Mount (Skylab).

#### b. *Types of Opportunity*

- (1) The most most common and sought after opportunity is to participate as Principal Investigator responsible for conceiving and conducting a space investigation.
- (2) There may also be an opportunity to serve on a Principal Investigator's team as a team member or as a Co-Investigator responsible for a subsystem or other aspect of the investigation.
- (3) A team or science advisory group may be formed to define a mission and to determine in a general manner the most meaningful scientific payload or instrumentation for that mission.
- (4) There may be guest observers, guest investigators or theorists or others utilizing a space instrument or data from space instruments, usually after the primary objectives have been satisfied for the instruments involved.
- (5) There may be investigators as recipients of returned samples for analysis.

- c. *Selection and Acquisition Procedures.* The special process for selection may be applicable to all of these types of opportunities. The supposition common in these opportunities is that the best ideas and approaches are likely to result from the broadest possible involvement of the scientific, technological or applications user communities. We are looking for the best innovative ideas. These are not susceptible to being specified. The process is a method of gathering the dissimilar ideas and subjecting them to peer group evaluation for merit and feasibility. The process also assigns to the investigators a role which brings to bear upon the investigations, their unique experience and insight.

### 3. FACILITY PAYLOADS

- a. *Examples.* Earth Resources Technology Satellite, Nimbus G, Earth Resources Experiment Package (Skylab), Sun-Earth Explorer.

b. *Types of Opportunity*

- (1) As members of an advisory group to recommend the sensors, performance criteria, and mission objectives of the space facility.
- (2) As guest observers utilizing a space instrument. The investigation proposed by the observer may include the provision of special purpose, ancillary instrumentation essential for the observation or use of the facility.
- (3) As users of data provided from space instruments.
- (4) Development and delivery of facility instrumentation.

- c. *Selection and Acquisition Process.* The Agency objectives inherent in the types of opportunities discussed in subpars. b(1)-(3) above would benefit from the wide search for unique ideas possible from the use of the special process. Investigators or observers may also require specialized flight or ground equipment in support of their investigation which would be appropriate for acquisition under the special process. The opportunity discussed in subpar. b(4) to develop and provide the instrumentation generally would not be appropriate for use of the process, because the NASA can use its ordinary program planning process to define the instruments needed for the anticipated variety of users and can use its ordinary procurement process to acquire the hardware.

### 4. MINOR MISSIONS

- a. *Examples.* Lear Jet, C-141, Sounding Rockets, Balloons. Minor missions are generally of short duration, small in size, often single purpose, and subject to repetition. Many experiments are follow-on to past flight experiments.

*b. Types of Opportunity*

- (a) Mission definition.
- (b) Principal Investigator responsible for investigation.
- (c) Data use or analysis.

*c. Selection and Acquisition Process.* Opportunities for participation on minor missions are generally suitable for normal procurement procedure. The use of an open invitation announcing the general nature and schedule of flights may be in order when considered necessary to broaden participation with ensuing proposals treated as unsolicited proposals within the context of Agency procurement procedures. Procurement procedures as contained in NASA Procurement Regulations should be used for follow-on repeat flights. Although the NASA seeks unique, innovative ideas for these missions, the prospect of reflight and the latitude in determining number and schedule of flights argue against the need for the use of the investigations acquisition process to force dissimilar proposals into an annual or periodic competitive structure. On the other hand, there are some minor missions addressed to specific limited opportunities; for example, a solar eclipse. When such limitations indicate that the special competitive structure is needed, it should be authorized.

**5. OPERATIONAL AND OPERATIONAL PROTOTYPE SPACECRAFT**

*a. Examples.* ITOS, TIROS, SMS.

*b. Types of Opportunity*

- (1) Participate in mission definition
- (2) Develop and provide instrumentation
- (3) Data use and analysis

*c. Selection and Acquisition Process.* The user agency can be expected to specify performance parameters. Payload definition will be the responsibility of the user agency and the NASA. Specifications sufficient for normal procedures can be produced. Use of data from the mission is the responsibility of the user agency. Thus, the special process is not required.

**6. REIMBURSABLE MISSIONS**

*a. Examples.* INTELSAT, NOAA.

*b. Selection and Acquisition Process.* Payload determination and delivery are the responsibility of the user organization. The NASA's role is essentially to provide launch services. No special process is required.

## **7. SUPPORTING RESEARCH AND TECHNOLOGY (SR&T)**

- a. Examples.* Studies, minor developments, instrument conceptualization, ground-based observations, laboratory and theoretical supporting research, and data reduction and analysis which is unconstrained by a specific opportunity.
- b. Selection and Acquisition Process.* Programs in these areas tend to go forward on a continuing basis, rather than exploiting unique opportunities. Normal procurement and program planning procedures should be utilized to satisfy these requirements. A general announcement of areas of interest could be made when greater participation is deemed advisable. Proposals can be solicited or unsolicited and can be entertained within the context of the NASA procedure.

## **8. ADVANCED APPLICATIONS FLIGHT EXPERIMENTS (AAFE)**

- a.* This is a specific program with a constrained level of effort funding to provide for instrumentation development. It is designed to develop potential flight instrumentation from a point of proven feasibility to readiness for construction of a prototype flight model.
- b. Selection and Acquisition Process.* AAFE is a special program. It has been set up separately for the past few years and has used annual Announcements to obtain proposals. Funds for AAFE are severely limited, while the number of potential instrument developments is very high. In relation to traditional Announcement usage, the set limitation of funds takes the place of a fixed flight opportunity competition. The use of an Announcement of Opportunity and the ensuing evaluation of dissimilar ideas at one time forces into a competitive structure the selections that otherwise would be made in more scattered fashion as SR&T.
- c.* While the AAFE program is young, the Agency has used the special process with good results in bringing promising experimental techniques along to a point where they are ready for assignment to future flight missions in a sufficiently defined state to facilitate intelligent and effective mission planning, payload integration, and cost control. For these reasons, the use of the special process for AAFE is acceptable. Care should be taken to solicit unique and unspecified ideas with only a general requirement, as there may be a tendency in some cases to specify desired instrument characteristics which would more properly be obtained through normal procurement processes.
- d.* It is true that AAFE tends to place hardware producers in preferred positions for future missions. This is unavoidable and not unfair, but AAFE participation should not by itself be a commitment for assignment to the future mission. Results of AAFE studies should be made publicly available. Normal standards should be applied in the later acquisition of flight hardware on a competitive or noncompetitive basis.
- e.* These characteristics of AAFE are presently peculiar to applications but may be applied to other disciplines which involve dissimilar ideas and are similarly



constrained as in AAFE. The intent to use the AO process for other than AAFE should be justified in the program approval document.

## **9. SHUTTLE PAYLOADS**

- a. Examples.* Spacelab missions, dedicated missions.
- b. Selection and Acquisition Process.* Like payloads on other missions, payloads for the Shuttle can be viewed in terms of their characteristics favoring or adverse to use of the special selection process. Since the Shuttle will be a transportation system, its flights may be expected to encompass all the types of opportunities we have discussed. In certain modes of use, the frequency of missions and the relaxation of weight and size limits are likely to broaden the opportunities for considering worthy ideas under ordinary processes and approving them for flight when ready instead of focusing them into competition for a specific flight or group of flights. In other modes such as Spacelab or dedicated flights with specific objectives, or specific limitations of capacity, the use of the special process may be appropriate for selection of a program of investigations.

## **203 SPECIFIC APPROVAL REQUIRED**

The Program Associate Administrator responsible for the program is also responsible for determining whether or not to use the special investigations acquisition process. Normally on major projects, or when a Project Plan is required, use of the investigation acquisition system will be justified and recommended in the project planning documentation, will be coordinated with staff offices and discussed in the planning presentation to the Associate Administrator or his designee. (The Agency procedure for planning, approval and review of major R&D projects is set forth in NMI 7121.1B.)

## **CHAPTER 3: THE ANNOUNCEMENT OF OPPORTUNITY**

### **300 GENERAL**

1. The essence of the competitive solicitation is through use of an Announcement of Opportunity. The Announcement is characterized by its generality since NASA has not predetermined a specific and finite objective but only the general objective of the investigations. In the same vein, the Announcement cannot follow, in a strict sense, a tailor-made format that is usually associated with other solicitations. It is essential that it contain sufficient data in order to obtain meaningful proposals. Important among the items it should contain are:
  - a. Specific guidelines established for the evaluation of proposals for a particular mission.
  - b. Requirements for sufficient cost data tailored to the investigative objectives to make meaningful analysis and trade-offs.
  - c. A statement of NASA prerogatives in the acquisition of any proposed or required instrumentation or services.
2. To a considerable extent, the detail and depth of the Announcement will depend on the investigative objective. In all cases, judgment is of paramount importance, since the purpose is to get adequate information to assess the relevance, merit, cost, and management without overburdening the proposer.

### **301 NEED FOR PREPARATORY EFFORT**

1. When the use of the Announcement process is contemplated, there is need to consult with other Headquarters offices and the Project Center prior to release of the Announcement. These consultations, using a draft Announcement, will require early involvement of the Project Center and other Headquarters offices in the investigation acquisition process.
2. In addition, the need to meet statutory requirements in the acquisition processes will require early external Program Office involvement to:
  - a. Obtain a class determination and findings approved at the appropriate level prior to the Announcement release.
  - b. Synopsise the Announcement in the Commerce Business Daily prior to the time of release.
  - c. Determine mailing lists, including the mailing list maintained by the Office of International Affairs, for broad dissemination of the Announcement to the appropriate recipients.

- d. Assure mandatory requirements are contained in the Announcement or follow-up responses to letters of intent to propose.
3. Other methods of dissemination of the Announcement may also be used, such as the use of press releases, etc. When possible, the Announcement should be widely publicized through publications of appropriate professional societies.

### 302 RESPONSIBILITIES

The Program Office originator is responsible for the content of the Announcement and that coordination with concerned offices and centers has been accomplished. All personnel involved in the evaluation of investigative proposals are responsible for familiarizing themselves and complying with this Handbook and other applicable regulations. To this end, they are expected to seek the advice and guidance of appropriate Headquarters program and staff offices, and Project Center management.

### 303 GUIDELINES FOR ANNOUNCEMENT OF OPPORTUNITY

1. The preparation of the Announcement of Opportunity should be a multifunctional effort. It involves program and project management and usually involves other offices of the NASA.
2. The Announcement should be tailored to the particular needs of the contemplated investigation and be complete in itself. The content of the Announcement normally would include the following or similar data and/or requirements.
  - a. *Description of the Opportunity*: Set forth the basic purposes or aim of the investigation.
  - b. *Mission Objectives*: Criteria or relevance of proposed investigation.
  - c. *Specific Requirements and Constraints Applicable*: Performance limitations, integrability, whether it is a limited payload opportunity (one time) or continuing, performance limits including life in flight environment, safety, reliability and quality assurance provisions for flight worthiness, further clarifying information as necessary for a meaningful proposal.
  - d. *Data and Other Requirements*: Data analysis requirements, schedule of data shipment to user or observer, requirement for preliminary or raw data analysis, and interim reports. The Announcement should also inform proposers that the topics of data rights, patent rights, copyrights, protection of proprietary information, and title to experimental equipment and materials will, as appropriate, be the subject of agreement upon selection, in accordance with NASA policies and regulations.
  - e. *Acquisition of Flight Hardware and Ground Support Equipment*: By submitting a proposal the investigator and his institution agree that the NASA has the option to

accept the offer's plan to provide the instrumentation required for the investigation or the NASA may furnish or obtain such instrumentation from any other source as determined by the selecting official.

- f. Tentative Selections, Partial Selections, and Participation with Others:* By submitting a proposal the investigator and his institution agree that the NASA has the option to make a tentative selection pending a successful feasibility or definition effort. The investigator should also understand that NASA may desire to select only a portion of his proposed investigation and/or that NASA may desire his participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its leader or contact point.
- g. Evaluation Criteria:* General evaluation criteria outlined in paragraph 400 should be included in the Announcement and specific criteria if suited to the requirement. If applicable, a general description of the relative importance of the criteria should be furnished. Cost will always be an evaluation criterion. (See paragraph 403.)
- h. Proposal Activities:* This includes the need for notices of intent to propose, preproposal conference, technical contact for questions and inquiries, and any data to be supplied with the notices of intent to propose.
- i. Format of Proposals:* To assure some uniformity to aid in proposal evaluation, a format for proposals similar to Appendix A should be requested.
- j. Cost Proposals (U.S. proposals only):* A statement that the investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that following selection and during negotiations leading to a definitive contract, the institution will be required to resubmit or execute a DD Form 633 (Contract Pricing Proposal) as well as submitting all other certifications and representations required by law and regulation.
- k. Receipt of Proposals:* The address to which proposals should be sent, the number of copies, and the latest date proposals can be received without being classified as late proposals and notice that late proposals will be handled in accordance with the NASA Procurement Regulations. A Notice of Receipt of Proposal will be furnished by the NASA to investigators. A minimum of 90 days is required between mailing of the Announcement and the deadline date set for receipt of proposals, unless determined otherwise by the Program Associate Administrator with advance notification to the Office of International Affairs.
- l. Foreign Proposals:* Proposals for participation by individuals outside the U.S. should be submitted in the same format (excluding cost plans) as U.S. proposals; they should be typewritten and be in English; the proposals should be reviewed and endorsed by the appropriate foreign governmental agency. If letters of "Intent to

Propose" are required, the Announcement should indicate that they be sent directly to the originating office with a copy sent to NASA's Office of International Affairs; all other correspondence (including proposals and endorsements) from foreign proposers and organizations should be sent to NASA's Office of International Affairs; and should a proposal be selected, NASA will arrange with the sponsoring foreign agency for the proposed participation on a cooperative (no exchange of funds) basis, in which NASA and the sponsoring agency will each bear the cost of discharging its respective responsibilities. Note that additional guidelines applicable to foreign proposers are contained under the Management Plan Section of Appendix A and must be included in every Announcement.

### **304 GUIDELINES FOR PROPOSAL PREPARATION**

While not all of the guidelines outlined in Appendix A will be applicable in response to every Announcement, the investigator should be informed of the relevant information required to allow for an evaluation of his proposal. The proposal may be submitted on a form to be supplied by the Program Office. However, the proposal should be submitted in at least two sections: (1) Investigation and Technical Section and (2) Management and Cost Section.

## **CHAPTER 4: EVALUATION OF PROPOSALS**

### **400 CRITERIA FOR EVALUATION**

1. The identification of ideas and unique capabilities which best suit the overall scientific and technological objectives of the program is a fundamental aim of the investigation acquisition process. Hence, the following general criteria should be used in all selections.
  - a. The relevance to the specific opportunity and to the established mission objectives.
  - b. The scientific and technological merit of the investigation including the desirability of the investigation within the discipline to which it pertains and the probability of acquiring positive results.
  - c. The competence and experience of the investigator as an indication of his ability to carry his investigation to a successful conclusion.
  - d. The adequacy of whatever apparatus may be proposed with particular regard to its ability to supply the data needed for the investigation.
  - e. The reputation and interest of the investigator's institution, especially from the viewpoint of whether the institution will provide necessary support to insure that the investigation can be completed satisfactorily.
  - f. Cost and management factors will be considered in all selections.
2. When a mission is suited to the definition of specific criteria tailored to its requirements, such specific criteria should be added to the general ones. They should then be described in the Announcement fully enough to inform evaluators and prospective proposers of the relative significance of matters to be addressed in the proposals. If the criteria, or its order of relative importance, should change (1) after issuance of the Announcement, all proposers should be informed; (2) after receipt of proposals, a new solicitation will be issued.

### **401 THE EVALUATION PROCESS**

1. The evaluation process assures consideration of the several aspects of the proposal and constitutes a series of progressive sortings of the proposals. A review is performed by an advisory subcommittee of the steering committee appointed by the Program Associate Administrator. The subcommittee is composed of a group of peers of the proposers and the purpose of the review is to determine the scientific and/or technological merit of the proposals in the context of the specific opportunity. Those proposals which are considered to have the greatest scientific or technological merit are reviewed for the engineering, management and cost aspects usually by the Project Office at the center

responsible for the project. The final aspects are those aimed at developing a group of investigations which represent an integrated payload or a well-balanced program of investigation which has the best opportunity for meeting the scientific or technological goals, schedule and cost objectives of the program.

2. The importance of considering the interrelationship of the several aspects of the proposals to be reviewed in the process and the need for carefully planning their treatment should not be overlooked. Some offices have developed and used an evaluation plan which has been found helpful to the evaluators, program management officials, and the selecting official. The evaluation plan should be developed before issuance of the Announcement of Opportunity. It covers the recommended staffing for the subcommittee or peer groups, review guidelines as well as the procedural flow and schedule of the evaluation. While not mandatory, such a plan should be considered for each Announcement. A fuller discussion of the evaluation and selection process is included in the following paragraphs.

#### 402 SUBCOMMITTEE EVALUATION

1. Evaluation of scientific merit of proposed investigations is the responsibility of a subcommittee of the steering committee. It is of prime importance that the appointment of members to the evaluation subcommittee be weighed carefully as these individuals will exercise significant influence on the selection of investigations and hence achievement of mission goals and objectives.
2. The evaluation subcommittee constitutes a peer group qualified to judge all investigation proposals submitted in response to the Announcement for participation in a specific mission or program. For a given application of the process, one or more subcommittees may be established depending on the breadth of the technical or scientific disciplines inherent in the mission. Each subcommittee represents a discipline or grouping of closely related disciplines. To maximize the quality of the subcommittee evaluation, the following conditions of selection and appointment should be considered:
  - a. The evaluation subcommittee normally should be established on an ad hoc basis for the particular mission referenced in the Announcement.
  - b. Qualifications and broad acknowledgement of the professional abilities of the subcommittee members are of primary importance. (Institutional associations, per se, are not sufficient qualifications.)
  - c. The Chairman and the Executive Secretary of the subcommittee must be full-time, regular NASA employees.
  - d. Subcommittee members should normally be appointed after receipt of notices of intent to propose, and prior to receipt of proposals; however, should it be necessary to appoint members after receipt of proposals, this should be brought to the attention of the appointing official.

- e. Members should be selected in a manner minimizing possible conflicts of interest. These include financial interest, institutional affiliations, professional biases and associations as well as familiar relationships. Such conflicts could occur as a result of imbalance between Agency and non-Agency appointees, a member evaluating a proposal from his parent organization, or membership from institutions representing a singular school of thought in discipline areas involving competitive theories in scientific approach to an investigation.
  - f. The subcommittee should convene as a group in closed sessions for proposal evaluation to protect the proposer's proprietary ideas and to allow frank discussion of the proposer's qualifications and the merit of his ideas. Lead responsibility for each proposal may be assigned to members most qualified in the involved discipline. But, it is important that each proposal be considered by the entire subcommittee. It is only through this action that dissimilar ideas are forced into open competition.
- 3. It may not be possible to select an evaluation subcommittee fully satisfying all of the above conditions. For example, the most qualified specialists in a particularly narrow discipline may themselves or some other part of their parent organization be submitting proposals. Alternatively, it may not be practical to involve new members in the evaluation process—thus, maintaining a cadre of qualified specialists for future appointments—because of special discipline needs. It is not the purpose of these guidelines to establish provisions for making trade-offs, where necessary, among the above criteria. This is properly the responsibility of the nominating and appointing officials. This latitude permits flexibility in making decisions in accord with the circumstances of each application. In so doing, however, it is emphasized that recognized expertise in evaluating dissimilar proposals is essential to the continued workability of the investigation acquisition process; and, should therefore, be accorded first importance.
  - 4. Candidate subcommittee members should be nominated by the Program Directorate having primary mission responsibility. Nominations should be approved in accordance with NMI 1156.4D. The notification of selection for appointment should specify the duration of assignment on the subcommittee, provisions concerning conflict of interests, and arrangements regarding honorariums, per diem and travel when actually employed.
  - 5. It is important that members of the subcommittee be formally instructed as to their responsibilities with respect to the particular mission/application of the investigation acquisition process—even where several or all of the members have served previously. The importance of this instruction stems from the flexibility deliberately built into the process facilitating its adaptation to each particular application. This briefing of subcommittee members should include:
    - a. Instruction of subcommittee members on Agency policies and procedures pertinent to selection and procurement of investigations.



- b. Review of the project goals, mission objectives, and selection criteria including relative importance, if any, which provide the basis for evaluation.
  - c. Instruction on the use of the preliminary proposal data furnished by the Project Office. The subcommittee should look at this data in conjunction with probable cost, integration, and management considerations to gain a better understanding of the proposed investigation and any associated problems so they can make tradeoffs of cost versus value.
  - d. Definition of responsibility of the subcommittee for evaluation with respect to scientific and/or technical merit; flight readiness, where appropriate; suitability to mission and Agency objectives; and cost performance potential.
  - e. Instruction for documentation of deliberations and recommendations of the subcommittee.
  - f. Inform the Chairman of the subcommittee and all members that they should familiarize themselves with the provisions of the current "Standards of Conduct for NASA Employees" (NHB 1900.1A) or "Standards of Conduct for NASA Special Government Employees" (NHB 1900.2A), as appropriate, regarding conflict of interest. Members should inform the appointing authority if his participation presents a real or apparent conflict of interest situation. In addition, all participants should inform the selection official in the event they are subjected to pressure or improper contacts.
  - g. Inform members that prior to the selection and announcement of the successful investigators and investigations, subcommittee members and NASA personnel shall not reveal any information concerning the evaluation to anyone who is not also participating in the same evaluation proceedings, and then only to the extent that such information is required in connection with such proceedings.
  - h. Inform members that subsequent to selection of an investigator and announcement of negotiations with his institution, information concerning the proceedings of the subcommittee and data developed by the subcommittee will be made available to others within NASA only when the requestor demonstrates a need to know for a NASA purpose. In this connection, reference is made to 18 U.S.C. 1905 which prohibits any officer or employee (including special employees) of the United States from disclosing or divulging certain kinds of business confidential and trade secret information unless authorized by law.
6. The product of the advisory subcommittee is the classification of proposals into four categories. The categories are:
- a. *Category I:* Well conceived and scientifically and technically sound investigations pertinent to the goals of the program and the objectives of the particular mission, and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can

be delivered on time and that data can be properly reduced, analyzed, interpreted, and published in a reasonable time. Investigations in Category I are recommended for immediate acceptance and normally will be displaced only by other Category I investigations.

- b. *Category II:* Well conceived and scientifically or technically sound investigations which are recommended for acceptance, but at a lower priority than Category I.
  - c. *Category III:* Scientifically or technically sound investigations which require further development of the associated experimental apparatus. Category III investigations may be funded for development and may be reconsidered at a later time for the same or other missions.
  - d. *Category IV:* Proposed investigations which are rejected for the particular mission under consideration, whatever the reason.
7. These definitions clearly embrace three evaluation measures of performance—scientific or technological return, probability of achieving it, and its value, including costs, in terms of mission objectives. They are outcome oriented, involving evaluation of the efficiency of experiment input requirements only to the extent to which they directly and significantly affect the likely outcome of the final experiment configurations and the gain of useful knowledge. They also indicate technical feasibility of performing on the specific mission.
8. A record of the deliberations of the subcommittee should be prepared by the assigned Executive Secretary and should be signed by the Chairman. The minutes should contain the categorizations with basic rationale for such ratings and the significant strengths and weaknesses of the proposals evaluated.

#### 403 COST, ENGINEERING, INTEGRATION, AND MANAGEMENT EVALUATION

1. The subcommittee should determine the categorization of each proposal in terms of its scientific or applications technical merit. However, the subcommittee should receive information on probable cost, technical status, developmental risk, integration and safety problems, and management arrangements in time for their deliberations.
2. This information should be provided where appropriate at the discretion of the Program Office by the Project Office at the cognizant center. This information can be in fairly gross, general terms and should reflect what insights the Project Office can provide without requesting additional details from the proposers. The Project Office should receive the proposals at the same time as the subcommittee and should conduct a preliminary review for this purpose. This kind of Project Office review will not normally give the subcommittees information on which they can rely as having much precision. The purpose is only to give the subcommittee sufficient information so they can look at proposals in conjunction with available cost, integration, and management considerations to gain an impression of each investigator's understanding of the mission and the problems of the experiment and to permit gross tradeoffs of cost versus value.
3. Following subcommittee categorization, for investigations still in the running, the Project Office shall evaluate proposals in depth, including a thorough review of each

proposal's engineering, integration, management, and cost requirements. This review should be supported or accomplished by qualified engineering, cost, and business analysts at the project center. The review must be a regular part of the evaluation and selection process.

4. In evaluating proposed costs, the evaluation must consider:
  - a. The investigative objective.
  - b. The amount budgeted or allocated for investigations.
  - c. Comparable, similar or related investigations.
  - d. Whether NASA or the investigator will procure the necessary supporting instrumentation or services and the relative cost of each mode.
  - e. Total overall or probable costs to the Government including integration and data reduction and analysis. In the case of investigations proposed by Government investigators, this includes all associated direct and indirect costs. With respect to cooperative investigations, integration and other applicable costs should be considered.
5. The investigation proposals which require instrumentation should be evaluated by both project scientific and engineering personnel. This evaluation should cover the critical spacecraft interfaces and the assessment of development risk. This evaluation should furnish the selection official with sufficient data to contribute to his instrument determinations. Important among these are:
  - a. That the instrument requires further definition and development.
  - b. Requires a preliminary definition phase.
  - c. Studies and designs necessary to provide a reasonably accurate appreciation of the cost.
  - d. The degree of performance to which the investigation can be carried without incurring undue cost, schedule, or risk of failure penalties.
  - e. The feasibility of integrating the instrument with the spacecraft and the balance of the payload.
6. In reviewing an investigator's management plan, the Project Office should evaluate his approach for efficiently managing the work, the recognition of essential management functions, and the effective overall integration of these functions. Evaluation of the proposals under final consideration should include, but not be limited to: Workload—present and future (related to capacity and capability); past experience; management approach and organization; e.g.:
  - a. With respect to workload and its relationship to capacity and capability, it is important to ascertain the extent to which the investigator is capable of providing

facilities and personnel skills necessary to perform the required effort on a timely basis. This review should reveal the need for additional facilities or people, and provide some indication of the Government support the investigator will require.

- b. A review should be made of the investigator, the investigator's institution, and any supporting contractors' performance on prior investigations. This should assist in arriving at an assessment of the investigator and his institution's ability to perform the effort within the proposed cost and time constraints.
- c. The proposed investigator's management arrangements including make or buy choices, support of any co-investigator, and preselected subcontractors or other instrument fabricators to determine whether such arrangements are justified. The review should determine if the proposed management arrangements enhance the investigator's ability to devote more time to the proposed experiment objectives and still effectively employ the technical and administrative support required for a successful investigation. In making these evaluations, the Project Office should draw on the center's engineering, business, legal, and other staff resources as necessary as well as its scientific resources. If further information is needed from the proposers, it should be obtained.

#### 404 PROGRAM DIRECTORATE EVALUATION

- 1. A Program Directorate responsible for the project or program at Headquarters will receive the evaluation of the several aspects of the proposals, and weigh the evaluative data to determine an optimum payload or program of investigation. This determination will involve recommendations concerning individual investigations; but, more important, should result in a payload or program which is judged to optimize total mission return within schedule, engineering, and budgetary constraints. The recommendations so made should facilitate sound selection decisions by the Program Associate Administrator. Three sets of recommendations result from the Program Directorate evaluation:
  - a. Optimum payload or program investigations (or options for alternative payloads or programs).
  - b. Recommendation for final or tentative selection based on a determination of the degree of uncertainty associated with individual investigations. A tentative selection may be considered step one of a two-step selection technique used to advantage.
  - c. As appropriate, recommendation regarding assigning responsibility for instrument development to the Principal Investigator.
- 2. The Project Office evaluation is principally concerned with ensuring that the proposed investigation can be managed, developed, integrated and executed with high probability of technical success within the estimated probable cost. The Program Director, drawing upon these inputs, should be mainly concerned with determining a payload or program

from the point of view of mission satisfaction within proprietary and budgetary constraints. Discipline and cost trade-offs are considered at this level. In this analysis, cost consideration does not require use of any differential as a unique evaluation factor; however, cost shall be examined with weight and volume and other integration factors as well as investigative value. The Program Office should focus on the potential contribution to mission objectives that can be achieved under alternative feasible payload integration options.

3. It may be to the NASA advantage to consider certain investigations for tentative selection pending resolution of uncertainties in their development. Such tentative selections should be reconsidered after a period of time for final selection in a payload or program of investigations. This two-step selection process should be considered when:
  - a. The potential return from the investigation is sufficiently great relative to that of the other investigations under consideration that its further development appears to be warranted before final selection.
  - b. The investigation potential is of such high priority to the mission that the investigation should be developed for flight if at all possible.
  - c. The investigative area is critical to the mission and competitive approaches need to be developed further to allow selection of the optimum course.
4. Based on evaluation of the above considerations associated with the investigations requiring further development of hardware, the following information should be provided to the Steering Committee and the Program Associate Administrator responsible for selection:
  - a. The expected gain in potential return associated with the eventual incorporation of tentatively recommended investigations in the payload(s) or program.
  - b. The expected costs required to develop instrumentation to the point of "demonstrated capability."
  - c. The risk involved in terms of added cost, probability of successfully developing the required instrument capability, and the possibility of schedule impact.
  - d. Identification of opportunities, if any, for inclusion of such investigations in later missions. This option may warrant consideration of an instrument research study funded under Supporting Research and Technology (SR&T).
5. In those cases where investigations are tentatively selected, an explicit statement should be made of the process to be followed in determining the final payload or program of investigations and the proposers so informed. The two phase selection approach provides the opportunity for additional assurance of development potential and probable cost prior to a full and final commitment to the investigation.

6. As instruments used in investigations become increasingly complex (and costly), the need for greater control of their development by the Program Office also grows. Accordingly, as an integral part of the evaluation process, a deliberate decision should be made regarding the role of the Principal Investigator with respect to the provision of the major hardware associated with his investigation. The guidelines for the hardware acquisition determination are discussed in paragraph 501-1b.
7. The range of options for responsibility for the instrumentation consists of:
  - a. Assignment of full responsibility to the Principal Investigator. The responsibility includes all in-house or contracted activity to fabricate, test, calibrate and provide the instrumentation for integration into the spacecraft.
  - b. Retention of developmental responsibility by the Government with participation by the Principal Investigator in key events defined for the program. In all cases the right of the Principal Investigator to counsel and recommend is paramount. Such involvement of the Principal Investigator may include:
    - (1) Provision of data specification.
    - (2) Approval of basic instrument specification.
    - (3) Independent monitorship of the development and advice to the Government on optimization of the instrumentation for conduct of the investigation.
    - (4) Participation in design reviews and all other appropriate reviews.
    - (5) Review and concurrence in changes resulting from design reviews.
    - (6) Participation in configuration control board actions.
    - (7) Advice in definition of test program.
    - (8) Review and approval of test program and changes thereto.
    - (9) Participation in conduct of the test program.
    - (10) Participation in calibration of instrument.
    - (11) Participation in final inspection and acceptance of the instrument.
    - (12) Participation in subsequent test and evaluation processes incident to integration and flight preparation.
    - (13) Participation in the development and support of the operations plan.
    - (14) Analysis and interpretation of data.

8. Normally, the Principal Investigator should as a minimum:
  - a. Provide the data specification.
  - b. Consult and advise the project manager in development and fabrication.
  - c. Participate in final calibration of the instrument.
  - d. Develop and support the operations plan.
  - e. Analyze and interpret the data.
9. The Project Center which has responsibility for implementing the program or project should make recommendations concerning the appropriate role for the Principal Investigators. The responsible Program Associate Administrator will determine the role, acting upon the advice of the responsible Headquarters Program Office and the Steering Committee. The Principal Investigators' desires will be respected in the negotiation of his role allowing him an avenue of appeal to the Program Associate Administrator and, of course, his right to withdraw from participation.
10. The Program Directorate responsible for the program should make a presentation to the Steering Committee with supporting documentation on the several decisions to be made by the Program Associate Administrator.

#### 405 STEERING COMMITTEE REVIEW

1. The most important role of the Steering Committee is to provide a substantive review of a potential payload or program of investigations and to recommend a selection to the Program Associate Administrator. The Steering Committee applies the collective experience and insight of representatives from the program and discipline communities and offers a forum for discussing the logic of the selection from those points of view. In addition to this mission-specific evaluation function, the Steering Committee provides central guidance to subcommittee chairmen and serves as a clearinghouse for problems and complaints regarding the evaluation and selection process. The Steering Committee is responsible for assuring adherence to required procedures. Lastly it is the forum where discipline objectives are weighed against program objectives and constraints.
2. The Steering Committee represents the means for exercising three responsibilities in the process of selecting investigations:
  - a. To review compliance with procedures governing application of the investigation acquisition process.

- b. To ensure that adequate and appropriate documentation has been made of the several steps in the evaluation process.
  - c. To review the results of the evaluation by the subcommittee, Project and Program Offices and to prepare an assessment or endorsement of a recommended payload to the Program Associate Administrator.
- 3. The purpose in exercising the first of these responsibilities is to insure propriety and consistency in the application of the process. In this sense, the Steering Committee is intended to provide the necessary check, balances, reviews and coordination established through procedures and controls inherent in conventional acquisition practices.
- 4. The second and third responsibilities of the Steering Committee are technical in nature. They require that the Steering Committee review the evaluations by subcommittee, the Project Office and the Program Directorate in terms of their completeness and appropriateness for forwarding to the Program Associate Administrator. Most important in this review are:
  - a. Degree to which results of evaluations and recommendations follow logically from the mission criteria on which the decisions are to be based.
  - b. Consistency with objectives and policies generally beyond the scope of affected Project/Program Offices.
  - c. Sufficiency of reasons stated for tentative recommendations of those investigations requiring further instrument research and development.
  - d. Sufficiency of reasons stated for determining responsibilities for instrument hardware development.
  - e. Sufficiency of reasons given for classifying proposed investigations in their respective categories.
  - f. Fair treatment of all proposals.
- 5. The Chairman of the Steering Committee makes recommendations to the selection official on the payload or program of investigations and notes caveats or provisions important for consideration of the selection official.

#### 406 PRINCIPLES TO APPLY

- 1. The above discussion contains a description of the evaluation function appropriate for a major payload or very significant program of investigation. The levels of review, evaluation and refinement described should be applied in those selections where warranted but could be varied for less significant selection situations. It is essential to consider the principles of the several evaluative steps but may not be essential to maintain strict adherence to the sequence and structure of the evaluation system described. The selection official is responsible for determining the evaluation process most appropriate for his selection situation using this chapter as a guide.



## CHAPTER 5: THE SELECTION PROCESS

### 500 GENERAL

1. The Program Associate Administrator is responsible for the final decision on those investigations to be selected for contract negotiation. This decision culminates the several types of evaluations and processes that can be summarized as follows:

| <i>Evaluation Stage</i> | <i>Principal Emphasis</i>  | <i>Result</i>  |
|-------------------------|--|--|
| Subcommittee            | Science or technological relevance, value, and feasibility   | Categorization of individual proposals                 |
| Project Office          | Engineering/cost/integration/management acceptability  | Assessment of proposal factors                         |
| Program Directorate     | Consistency with mission or program objectives, and cost and schedule constraints                      | Recommendation of payload or program of investigations |
| Steering Committee      | Logic of proposed selection and review of adequacy of the evaluation from program and discipline goals | Assurance that evaluation was completed properly       |

### 501 DECISIONS TO BE MADE

1. The selection decisions by the Program Associate Administrator constitute management judgments balancing individual and aggregate scientific or technological merit, the contribution of the recommended investigations to project/mission objectives and their consonance with budget constraints. In so doing, the selection official may develop such additional data as he requires to make the following decisions:
  - a. Determination of the adequacy of scientific/technical analysis supporting the recommended selections. This supporting rationale should involve considerations including:
    - (1) Assurance that the expected return contributes substantially to mission objectives and is likely to be realized.
    - (2) Assurance that the evaluation criteria were applied consistently to all proposed investigations, thus ensuring that selection and rejection decisions are proper and fair.
    - (3) Assurance that the set of recommended investigations constitute the optimum program or payload considering potential value and constraints.

- (4) Assurance that only one investigator is assigned as the Principal Investigator to each investigation and that he will assume the associated responsibilities and be the single point of contact and leader of any other investigators selected for the same investigation.
  - b. Determination of whether the proposed instrument fabricator qualifies and should be accepted as a sole source or whether the requirement should be subjected to competitive solicitation. The following guidelines apply:
    - (1) The hardware requirement should be subjected to competitive solicitation in those instances where it is clear that the capability is not sufficiently unique to justify sole source procurement.
    - (2) The hardware requirement should be purchased from the fabricator proposed by the investigator, which may be his own institution, (1) when the fabricator's proposal contains technical data that are not available from another source, and it is not feasible or practicable to define the fabrication requirement in such a way as to avoid the necessity of using the technical data contained in the proposal; (2) when the fabricator offers unique capabilities that are not available from another source; or (3) when the selection official determines as part of his selection that the hardware of the particular fabricator contributes so significantly to the value of the investigator's proposal as to be an integral part of it.
    - (3) If a producer other than the one proposed by the investigator offers unique capabilities to produce the hardware requirement, NASA may buy the hardware from that qualified fabricator.
  - c. Determination of the desirability for tentative selection of investigations where recommended. This determination involves considerations including:
    - (1) Assessment of the state of development of the investigative hardware, the cost and schedule for development in relation to the gain in potential benefits at the time of final selection.
    - (2) Assurance that there is adequate definition of investigation hardware to allow parallel design of other project hardware.
    - (3) Assurance that appropriate management procedures are contained in the project plan for reevaluation and final selection (or rejection) on an appropriate time scale.
  - d. Determination of the acceptability of the proposer's management plan, including his proposed hardware development plan, and the necessity, if any, of negotiating modifications to that plan.
2. In the process of making the above determinations, the Program Associate Administrator may request additional information or evaluations. In most instances, this information can be provided by the Program Directorate responsible for the mission,

project or program. However, where it is determined appropriate, the Program Associate Administrator may reconvene the subcommittee or poll the members individually or provide for additional analysis or require additional data from evaluators or proposers as considered necessary to facilitate his decision.

## **502 THE SELECTION STATEMENT**

1. Upon completion of his deliberations, the Program Associate Administrator shall issue a selection statement. The selection statement may take the form of an approval of the steering committee's recommendations. As a minimum, the selection statement or the approved committee's recommendations should include:
  - a. The general and specific evaluation criteria and relative importance used for the selection.
  - b. The categorizations provided by the subcommittee and the basic rationale for accepting or not accepting each Category I proposal and a succinct statement concerning the non-acceptance of all other proposals.
  - c. A concise description of each investigation accepted.
  - d. The role of the Principal Investigator with regard to hardware essential to the investigation and whether the Principal Investigator will be responsible for hardware acquisition and the basis therefor.
  - e. An indication of the plan of acquisition using the regular procurement processes, if the Principal Investigator is not to acquire the hardware.
  - f. A statement indicating whether the selection is final or tentative, recognizing the need for better definition of investigative hardware and cost.

## **503 NOTIFICATION OF PROPOSERS**

1. As a result of the selection decisions made by the Program Associate Administrator, letters of notification will be sent to those Principal Investigators selected to participate. This notification letter should not commit the Agency to more than negotiation for the selected investigation leading to a contract; but it should clearly indicate the decision made and establish the scope of the anticipated contract with regard to the investigation parameters, role of the selectee in hardware acquisition, his rights and authority and the tentative or final nature of the selection. (Selected foreign investigators should receive letters of notification similar to those sent to U.S. selectees with a copy to the sponsoring foreign government agency.)
2. The notification letter should contain:
  - a. A concise description of the Principal Investigator's investigation as selected specifically noting substantive changes, if any, from the investigation originally proposed by the Principal Investigator.

- b. The nature of the selection, i.e., whether it should be considered final or tentative requiring additional hardware or cost definition.
  - c. A description of the anticipated role of the Principal Investigator including his responsibility for the provision of instruments for flight experiments.
  - d. Identification of the principal technical and management points to be treated in subsequent negotiations.
  - e. Any rights to be granted on use of data, publishing of data, and duration of use of the data.
  - f. Where applicable, the indication that a foreign selectee's participation in the program will be arranged between NASA's Office of International Affairs and the foreign government agency which endorsed the proposal.
3. In conjunction with the notification of successful foreign proposers, the Program Office shall forward a memorandum to the Office of International Affairs addressing the following:
- a. The overall scientific technological objective of the planned cooperative effort.
  - b. The period of time during which the effort is planned.
  - c. The respective responsibilities of NASA and of the sponsoring (endorsing) governmental agency; these may include:
    - (1) provision and subsequent disposition of hardware and software,
    - (2) responsibilities for reporting, reduction and dissemination of data,
    - (3) responsibilities for transportation of hardware.
  - d. Any additional information pertinent to the successful conduct of the experiment.

Using the information provided above, the Office of International Affairs will prepare and negotiate an agreement with the sponsoring foreign agency.

4. Notices shall also be sent to those proposers not selected, and as applicable, a copy to the sponsoring foreign government agency. It is important that the unsuccessful proposers be advised at the same time as those selected. Other agency notifications and press release procedures will apply as appropriate.

#### 504 DEBRIEFING

It is the policy of the National Aeronautics and Space Administration to debrief, if requested, unsuccessful proposers of investigations in a manner consistent with the principles of NMI 5103.1A "Debriefing of Unsuccessful Companies in Competitive

Negotiated Procurements." The following considerations are offered in arranging and conducting debriefings:

- a. Debriefings should be carried out by an official designated by the Program Associate Administrator. Any other NASA personnel receiving requests for information concerning the rejection of a proposal should refer the request to the designated official.
- b. Debriefing of unsuccessful offerers should be made at the earliest possible time; debriefings will generally be scheduled prior to award of contracts to the successful proposers.
- c. Material discussed in debriefings should be factual and wholly consonant with the documented findings of the several stages of the evaluation process and the selection statement.
- d. The debriefing official should advise of weak or deficient areas in the proposal, indicate whether those weaknesses were factors in the selection and advise of the major considerations in selecting the competing successful proposer where appropriate.
- e. The debriefing official should not discuss other unsuccessful proposals, ranking, votes of members or attempt to make a point-by-point comparison with successful proposals.
- f. A memorandum of record of the debriefing should be provided the Chairman of the Steering Committee.

## CHAPTER 6: PROCUREMENT AND OTHER CONSIDERATIONS

### 600 EARLY INVOLVEMENT ESSENTIAL

1. The distinctive feature of the Announcement of Opportunity process is that it is both a program planning system and a procurement system in one single procedure. The choice of what aeronautical and space phenomena to investigate is program planning. Procurement is involved with the purchase of property and services to carry out the selected investigations.
2. Because of both the programmatic and multi-functional aspects of the Announcement of Opportunity process, early involvement of external program office elements is essential. Success of the process requires that it proceed in a manner that meets program goals and is clearly in line with statutory requirements and sound procurement policy.
3. The planning, preparation, and selection schedule for the investigation should commence early enough to meet the present statutory and regulatory requirements. Chief of these are the requirements for making a determination and findings to justify contract negotiation, for soliciting maximum feasible competition, and for conducting discussions with offerors within the competitive range by the Project Office and any other evaluation group or office authorized by the selection official.

### 601 NEGOTIATION, DISCUSSIONS, AND CONTRACT AWARD

1. Indicated below are some of the major procurement procedures that need to be accomplished or performed to assure uniformity and sufficiency in the acquisition of investigations. These areas are not exclusive and not intended to substitute for adequate coordination and good judgment before issuance of the Announcement, during evaluation of proposals, and prior to contract award.
  - a. Significant items for consideration prior to issuance of an Announcement of Opportunity:
    - (1) *Determination and Findings.* A prerequisite to negotiation is the ascertainment that formal advertising is not feasible or practicable. A written Determination and Findings (D&F) to negotiate for property or services that are determined to be "for experimental, developmental, or research work" in excess of \$100,000 must be made by the Administrator or Deputy Administrator. Since it is known that investigation proposals received in response to an Announcement will undoubtedly require negotiation with the selected investigator's institution, a D&F to cover the class of contracts contemplated appears appropriate. A class D&F covering the anticipated contracts should be executed prior to the release of the Announcement.

- (2) *Synopsis.* Negotiated procurements must be made by soliciting proposals from the maximum number of qualified sources consistent with the requirement. In addition to the Announcement of Opportunity mailing list, the Announcement should also be synopsisized in the Commerce Business Daily. Every effort should be made to publish opportunities far enough in advance to encourage a broad response.

**b. Significant items for consideration after receipt of proposals:**

- (1) *Late Proposals.* The NASA policy on late proposals contained in the NASA Procurement Regulations (NASA PR 3.802-4(c)) is applicable to proposals received in response to an Announcement of Opportunity. Potential investigators should be informed of this policy.

(2) *Conducting Discussions with Offerors Within the Competitive Range*

- (a) The acquisition of investigations involves the solicitation of unique, novel, and unspecified ideas to meet NASA's aeronautical and space responsibilities. The proposals submitted in response to these solicitations are not necessarily fully comparable. Rather, these are discrete, novel scientific and technical investigative ideas associated with a limited opportunity. These opportunities may be bounded by weight, power and available funds for a specific mission.
- (b) Cost must be considered in the subcommittee evaluation if costs are involved in the investigation. Accordingly, general cost information should be given to the evaluation subcommittee by the Project Office for use in determining the categories into which they place proposals. This procedure can serve as a competitive range determination associated with the ordinary acquisition process.
- (c) Further information should be obtained as necessary from the investigators whose proposals are still being considered. This would be similar to the regular procurement procedure for conducting written or oral discussions. A major consideration during discussions is to avoid unfairness and unequal treatment. Obviously, good judgment is required by all concerned in the extent and content of the discussions. There should be no reluctance in obtaining the advice and guidance of management and staff offices during the discussion phase. A summary should be prepared of the primary points covered in the written and oral discussions and show the effect of the discussions on the evaluation of proposals. This summary should also contain general information about the questions submitted to the investigators, the amount of time spent in oral discussions, and revisions in proposals, if any, resulting from the discussions.
- (d) During the conduct of discussions, all proposers still being considered shall be offered an equitable opportunity to submit such cost, technical or other revisions in their proposals as may result from the discussions. All proposers

shall be informed that any revisions to their proposals must be submitted by a common cut-off date in order to be considered. The record should take note of compliance of the investigators with that cut-off date.

c. Significant items for consideration before award:

- (1) *Cost Sharing.* Consideration should be given to the appropriateness of cost sharing in accordance with the NASA policy relating to solicited proposals.
- (2) *Issuance of a Request for Proposal (RFP).* A formal RFP should not be issued to obtain additional information on proposals accepted under the Announcement of Opportunity process. Additional technical, cost, or other data received should be considered as a supplement to the original proposal.
- (3) *Selection of Investigator/Contractor.* The selection decision of the Program Associate Administrator approves the selected investigators and their institutions as the only satisfactory sources for the investigations. The selection of the investigator does not constitute the selection of his proposed supporting instrument fabricator unless the selection official specifically incorporates the fabricator in his selection decision.

## 602 APPLICATION OF NASA PROCUREMENT REGULATIONS (NHB 5100.2)

The Announcement of Opportunity process supplants normal procurement competitions only to the extent necessary to meet the distinctive features of the process that it is both a program planning system and a procurement system in one single procedure. This process is not intended to conflict with any established statutory requirements. The NASA Procurement Regulations and related procurement directives should be referred to for guidance and clarification in those instances where specific instructions are not contained in this Handbook.

## 603 OTHER ADMINISTRATIVE AND FUNCTIONAL REQUIREMENTS

After selection, all other applicable administrative and functional requirements will be compiled with or incorporated in any resultant contract. These may include requirements contained in such publications as NHB 5300.4(1B) "Quality Program Provisions for Aeronautical and Space System Contractors," and NHB 9501.2A "Procedures for Contractor Reporting of Correlated Cost and Performance Data."



## **APPENDIX A: GUIDELINES FOR PROPOSAL PREPARATION**

The following guidelines apply only to the preparation of proposals by potential investigators in response to an Announcement of Opportunity. The material presented is merely a guide for the prospective proposer, and not intended to be all encompassing or directly applicable to the various types of proposals which can be submitted. The proposer should, however, provide information relative to those items applicable to his proposal or as otherwise required by the Announcement of Opportunity or on the NASA proposal form furnished or referenced.

### **1. COVER LETTER**

A letter or cover page should be forwarded with the proposal. It should be signed by the investigator and an official by title of the investigator's organization who is authorized to commit the organization that is responsible for the proposal and its contents.

### **2. TABLE OF CONTENTS**

The proposal, if not submitted on a form furnished by NASA, should contain a table of contents.

### **3. IDENTIFYING INFORMATION**

The proposal should contain a short descriptive title for the investigation, the names of all investigators, the name of the organization or institution. The full name of the Principal Investigator, his address with zip code, and his telephone number.

## **SECTION I - INVESTIGATION AND TECHNICAL PLAN**

### **1. INVESTIGATION AND TECHNICAL PLAN**

The investigation and technical plan generally will contain the following:

- a. Summary.* A simple, concise statement about the investigation, its conduct, and the anticipated results.
- b. Objectives and Significant Aspects.* A brief definition of the objectives, their value, and their relationships to past, current, and future efforts. The history and basis for the proposal and a demonstration of the need for such an investigation. A statement of present development in the discipline field.
- c. Investigation Approach.*
  - (1) Fully describe the concept of the investigation.
  - (2) Detail the method and procedures for carrying out the investigation.

- (3) Present the performance criteria for the proposed investigation including measurements to be made and ranges of numerical values expected.
- (4) Explain the function and demands on the astronaut, crew payload specialists, and ground support crews.
- (5) Present prime obstacles or uncertainties which can be anticipated.
- (6) Identify supporting studies necessary to the investigation.
- (7) For proposals involving flight, the orbit desired and the effects of deviations from this orbit on the attainment of the objectives, should be included.
- (8) Constraints which may be placed on other instruments should be discussed.

## 2. *INSTRUMENTATION*

- a. If applicable, this section will include the instrumentation description as well as any required supporting services.
- b. *Instrument Description.* Fully describe the instrumentation required. This should include the following:
  - (1) Weight, volume, shape, with tolerances
  - (2) Power profile in all modes
  - (3) Telemetry requirements
  - (4) Data acquisition duty cycle
  - (5) Susceptibility to or production of RFI, magnetic interference, or other interference sources
  - (6) Command requirements
  - (7) Ground support equipment and operations
  - (8) Special mechanical linkage or control requirements
  - (9) Temperature
  - (10) Dynamic range, signal to noise ratio, time resolution, bandwidth requirements (give limits where pertinent)
  - (11) Data storage

(12) Prelaunch support

(13) Present state of development

(14) Design life of instrument

(15) Denote the location on the craft, viewing direction, openings, pointing accuracy and stabilization required and mounting requirements

(16) Indicate essential or desirable supporting investigations.

### 3. *DATA REDUCTION AND ANALYSIS*

A discussion of the data reduction and analysis plan including the method and format. A section of the plan should include a schedule for the submission of reduced data to the receiving point as specified by the "Technical Contact." In the case of Space Science programs, the National Space Science Data Center (Greenbelt, MD) will be the repository for such data and Department of the Interior (Sioux Falls, SD) for Earth Observations data.

### 4. *RESULTS EXPECTED*

A general indication of the anticipated results and their implications should be included.

### 5. *ASTRONAUT SUPPORT*

A description of the tasks, equipment used and task duration for each astronaut required. Indicate special training necessary to provide the astronaut with the capability for performing the aforementioned tasks.

### 6. *FLIGHT OPERATIONAL REQUIREMENTS*

Those operational requirements which do not directly involve the flight crew should be delineated. Details of communication need, tracking needs, and special techniques, such as extravehicular activity or restrictions in the use of control thrusters at stated times should be delineated. If the support of network range stations is required, it must be explained. Special communications facilities that are needed must be described. Any special trajectory requirement, such as time of month, of day, phase of moon, and lighting conditions are to be given in detail. Describe real time ground support requirements and indicate any special equipment or skills required of ground personnel.

### 7. *RECOVERY REQUIREMENTS*

The size and weight of recoverable equipment, its durability, special handling techniques, radiation, temperature and humidity control requirements, time factor and motion limitations must be given.

## **SECTION II - MANAGEMENT PLAN AND COST PLAN**

### **A. MANAGEMENT PLAN**

The management plan should summarize the management approach and the facilities and equipment required. Additional guidelines applicable to non-U.S. proposers are contained herein:

#### **1. MANAGEMENT**

- a. The management plan sets forth the investigator's approach for efficiently managing the work, the recognition of essential management functions, and the effective overall integration of these functions.
- b. The management plan gives insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with the NASA, major subcontractors and associated investigators. Likewise the management plan usually, reflects various schedules necessary for the logical and timely pursuit of the work accompanied by a description of the investigator's work plan and the responsibilities of the co-investigators.
- c. The plan should describe the proposed method of instrument acquisition. Specifically, it should include the following, as applicable:
  - (1) The rationale for the investigator to obtain the instrument through or by his institution.
  - (2) The method and basis for the selection of the proposed instrument fabricator.
  - (3) The unique or proprietary capabilities of the instrument fabricator that are not available from any other source.
  - (4) The contributions or characteristics of the proposed fabricator's instrument that make it an inseparable part of the investigation.
  - (5) Availability of supporting personnel in the institution to successfully administer the instrument contract and technically monitor the fabrication.
  - (6) State the status of development of the instrument. What additional development is needed. Areas that need further design or in which unknowns are present.
  - (7) Describe the method by which the investigator proposes to:
    - (a) Prepare instrument specifications
    - (b) Review development progress

- (c) Approve design and fabrication changes
- (d) Participate in testing program
- (e) Perform final checkout and calibration
- (f) Provide for integration of instrument into the spacecraft
- (g) Support the flight operations
- (h) Coordinate with co-investigators, spacecraft contractor and other related investigations
- (i) Execute tasks for the assurance of safety, reliability and quality

## 2. *FACILITIES AND EQUIPMENT*

All major facilities, laboratory equipment, and ground-support equipment (GSE) (including those of the investigator's proposed contractors and those of NASA and other U.S. government agencies) essential to the experiment in terms of its system and subsystems are to be indicated, distinguishing insofar as possible between those already in existence and those that will be developed in order to execute the investigation. The outline of new facilities and equipment should also indicate the lead time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

## 3. *ADDITIONAL GUIDELINES APPLICABLE TO NON-U.S. PROPOSERS ONLY*

The following guidelines are established for foreign responses to NASA's Announcements of Opportunity. Unless otherwise indicated in a specific announcement, these guidelines indicate the appropriate measures to be taken by foreign proposers, prospective foreign sponsoring agencies, and NASA leading to the selection of a proposal and execution of appropriate cooperative arrangements. They include the following:

- a. Where a "letter of intent to propose" is requested, prospective foreign proposers should write directly to the NASA official designated in the Announcement of Opportunity and send a copy of this letter to the Office of International Affairs, NASA, Washington, D.C. 20546, U.S.A.
- b. Unless otherwise indicated in the Announcement of Opportunity proposals will be submitted in accordance with these NASA "Guidelines for Proposal Preparation." Proposals should be typewritten and in English.
- c. Persons planning to submit a proposal should arrange with an appropriate foreign governmental agency for a review and endorsement of the proposed activity. Such endorsement by a foreign governmental organization indicates:
  - (1) The proposal merits careful consideration by NASA.

- (2) If the proposal is selected, sufficient funds will be available to undertake the activity envisioned.
- d. Proposals (along with the requested number of copies) and letters of endorsement from the foreign governmental agency should be forwarded to NASA in time to arrive before the deadline established for each Announcement of Opportunity. These documents should be sent to:

National Aeronautics and Space Administration  
Office of International Affairs  
Code I  
Washington, D.C. 20546  
U.S.A.

- e. All proposals should be received before the established closing date; those received after the closing date will be treated in accordance with NASA's provisions for late proposals. Sponsoring agencies may, in exceptional situations, forward an endorsed proposal directly to the above address if review and endorsement is not possible before the announced closing date. In such cases, NASA should be advised when a decision on endorsement can be expected.
- f. Shortly after the deadline for each Announcement of Opportunity, NASA's Office of International Affairs will advise the appropriate sponsoring agency which proposals have been received and when the selection process should be completed. A copy of this acknowledgement will be provided to each proposer.
- g. Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the Announcement of Opportunity. Copies of these letters will be sent to the sponsoring governmental agency.
- h. NASA's Office of International Affairs will then begin making the necessary arrangements to provide for the selectee's participation in the appropriate NASA program. Depending on the nature and extent of the proposed cooperation, these arrangements may entail:
- (1) a letter of notification by NASA,
  - (2) an exchange of letters between NASA and the sponsoring foreign governmental agency,
  - (3) an agreement or Memorandum of Understanding between NASA and the sponsoring foreign governmental agency.

#### B. COST PLAN (U.S. Investigations Only)

The cost plan should summarize the total investigation cost by major categories of cost as well as by function.

1. The categories of cost should include the following:

- a. *Direct Labor.* List by labor category, with man-hours and rates for each. Provide actual salaries of all personnel and the percentage of time each individual will devote to the effort.
- b. *Overhead.* Include indirect costs, which because of its incurrence for common or joint objectives, is not readily subject to treatment as a direct cost. Usually this is in the form of a percentage of the labor direct costs.
- c. *Materials.* This should give the total cost of the bill of materials including estimated cost of each major item. Include lead time of critical items.
- d. *Subcontracts.* List those over \$25,000, specify the vendor and the basis for estimated costs. Include any baseline or supporting studies.
- e. *Special Equipment.* Include a list of special equipment and lead and/or development time.
- f. *Travel.* List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.
- g. *Other Costs.* Costs not covered elsewhere.
- h. *General and Administrative Expense.* This includes the expenses of the institutions general and executive offices and other miscellaneous expenses related to the overall business.
- i. *Fee (if applicable).*

2. Separate schedules, in the above format, should be attached to show total costs allocable to the following:

- a. Principal Investigator and other Investigator's costs.
- b. Instrument costs.
- c. Integration costs.
- d. Data reduction and analysis including the amount and cost of computer time.

3. If the effort is sufficiently known and defined, a funding obligation plan should provide the proposed funding requirements of the investigation by quarter and/or annum keyed to the work schedule.

## APPENDIX B

### BATTELLE DEVELOPMENT CORPORATION (BDC)

BDC is a wholly owned, not-for-profit subsidiary of Battelle Memorial Institute (Battelle). Established in 1925, Battelle has as its overall objective the advancement and utilization of science for the benefit of mankind through the processes of technological innovation and education. Since its incorporation in 1935, BDC has been performing its assigned function to fulfill this objective of Battelle. It does this through the encouragement and development of discoveries and inventions for economic utilization by existing industrial enterprises. In the process BDC expects to realize an appropriate financial return to permit continuation of the activity.

The identification and encouragement of sources of discoveries and inventions is a vital, and necessary, activity of BDC. Inventors are invited to submit their discoveries to BDC for evaluation. If the evaluation shows that the invention has merit, BDC may acquire an interest in the invention. When this is done, BDC funds are invested in research and development, patenting activities, market studies, and the licensing of the invention. Once licensed, continuing assistance is provided to the licensees to insure that an advantageous patent position is maintained and that the invention is brought into use for the benefit of the public. The implementation of the above BDC activities involves a number of functional operations.

Various sources of inventions must be encouraged and cultivated by BDC since this function provides the foundation necessary for the fulfillment of its objectives.

Battelle Laboratories. A program of assistance is maintained at each of the laboratories of Battelle for helping staff members identify new inventions and obtain support for their development.



Independent Inventors. Individual inventors are invited and encouraged to submit their patentable ideas to BDC for evaluation. If the results of the evaluation show that an idea has potential value, BDC may wish to negotiate an agreement with the inventor. The usual agreement with individual inventors provides for sharing the income received from licensing or selling the invention with the inventor. BDC assumes responsibility for all necessary patent work; the research and development needed to bring this invention to the point of licensing or sale; and the marketing and legal effort required to consummate a suitable arrangement with industry. In return, the individual inventor gives BDC title to the invention.

BDC's service to inventors can be most helpful and expeditious when the explanatory data on the idea is submitted as a complete description, together with sketches or photographs, signed by the person whose ideas are presented, and witnessed by competent persons who are familiar with the subject of the idea. In the event a patent application has already been filed, or a patent issued, a copy of the application or patent should be provided.

Prior to acceptance by BDC, each invention is evaluated for technical feasibility, patentability, and marketability. The evaluation is quite rigorous and is designed to determine the state of technical development of the invention and its patent and market potential, as well as to estimate the extent of research and development work that may be required to make the invention marketable.

The following criteria are used in the screening of all ideas and inventions received by BDC. Those ideas of greatest interest to BDC provide an opportunity for a significant improvement to a device, mechanism, or process through additional research and development effort. Inventions having potential for a strong patent coverage are sought. Inventions without security classification are preferred. Ideas requiring a relatively large-scale pilot operation before licensing are least desirable for BDC participation. Finally, BDC carefully considers the nature of the ultimate market for those inventions that have been conceived and/or developed with the aid of U. S. Government funds before deciding on further evaluation or participation.

BDC prefers to be given first opportunity to evaluate an invention. If an invention has been previously submitted to other organizations, BDC would appreciate knowing the reason for its rejection.

When an invention has favorably passed initial screening, the task of predicting the ultimate scientific and commercial success of the final product is attempted. There are three major factors that are considered in assessing the success of an idea or invention:

- (1) Opportunity for the ultimate development (potential market)
- (2) The degree of patent protection that can be obtained (ability to achieve and retain a strong proprietary position).
- (3) Technical soundness of the concept (the potential of successful development of the invention within the scope of reasonable technical effort).

Also, the development of peripheral technology that could strongly influence, positively or negatively, the commercial success of the invention must be carefully followed.

A critical consideration at this stage of the evaluation is the market potential of the product or process and, in most cases, the license planning begins before an idea is finally accepted for development.

Development programs are initiated, generally, but not necessarily, at one of the Battelle laboratories for those inventions that pass the evaluation. As the technical development proceeds, the potential market is further defined. Patent activities are maintained through the development program to assure the formation of a patent structure that will offer the greatest protection for the invention.

One of the most important steps in BDC's operation is the licensing of its inventions. All inventions being developed by BDC receive continuing marketing evaluation. The actual licensing process begins after there is sufficient research data, market information, and patent protection to convince an industrial organization that it is worthwhile to invest in the commercialization of the specific invention. Each invention is considered individually and its licensing strategy established on the basis of the particular market area and industrial organizations which would be involved. Efforts to maintain and strengthen a patent position continue after a license has been granted.

Enclosed, as part of this appendix, are two documents that BDC provides to inventors who may want BDC to evaluate their idea or invention. One document is a suggested outline for disclosure of invention and the other covers procedures for submission of ideas or inventions to BDC; what BDC does with the invention once it is submitted; types of inventions not acceptable to BDC and a discussion on the chances an invention may have for successful commercialization.



**Battelle**

Development Corporation

505 King Avenue

Columbus, Ohio 43201

## SUGGESTED OUTLINE FOR DISCLOSURE OF INVENTION

**INVENTION DISCLOSURE:**

(Title)

**INVENTOR(S):**

(Print full names)

**SUBMITTED BY:**

(Identify name of University, College, Company, Laboratory, Institution, or indicate if Individual Inventor)

**OBJECTIVE:**

(General purpose of invention)

**STATE OF ART:**

*Current:*

(Describe present method(s), if any, of performing the function of the invention; list references if possible.)

*Disadvantages:*

(Disadvantages of current methods)

**INVENTION DESCRIPTION:**

(Construction of invention showing changes, additions, and improvements over old methods. Where applicable, illustrate invention with sketches, drawings or photographs in which the parts referred to are identified by reference number or by name. Give details of operation. You are encouraged to reference and attach any write-ups of invention used for other purposes for description.)

(If the invention relates to composition of matter, include the following additional points in the disclosure:

- a. Show the general properties required for each class of materials used. If possible, list at least three examples in each class. Explain the method of preparing any new material for which a method of preparation is not already known.
- b. Set forth *proportions* of materials, and conditions, expressed in the form of the widest reasonable ranges that will work. Also, mention narrower limits within these ranges that will provide optimum results. State the disadvantages of using proportions or conditions outside the ranges selected.
- c. Give *specific examples* of practice of the invention, in various modifications, and with the preferred proportions and conditions. The examples should illustrate diverse conditions under which the invention may be practiced.)

**Novel Aspects:**

(Describe any *surprising results* that would not have been forecast by an "expert in the art". Explain the surprising results, if possible. Emphasize any results that are contrary to what was to have been expected.)

**Principles:**

(Explain the operating principles of the invention.)

**Advantages:**

(Over what has been done previously)

**Disadvantages:**

(Biggest question or weakness)

**Alternate Methods:**

(Of construction or operation of invention)

**PUBLIC DISCLOSURE OF INVENTION:** (Thesis, Abstract, Speech, Article, or Other. Include copy and date if possible. If a speech, give date and circumstances.)

**COMMERCIAL INTEREST:** (Companies that have expressed an interest, or should be interested in the invention.)

**COMMITMENTS:** (If supported by government contract, identify grant or contract and rights available. If individual, identify other assignees.)

**WITNESSES:** (After the disclosure is prepared, it should be signed at the end by each inventor, as indicated below. The disclosure should then be read and witnessed by at least one other person, as indicated below.)

Inventor \_\_\_\_\_  
First Name Middle Initial Last Name Date

Disclosed to and understood by the undersigned on the dates indicated:

WITNESS \_\_\_\_\_ DATE \_\_\_\_\_

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# I. PROCEDURE FOR SUBMISSION OF IDEAS OR INVENTIONS TO BDC

It is a policy of BDC that all invention submissions made to BDC must be made in writing by the individual or organization which holds legal title to the intellectual property. Such submission in writing must be made prior to any interview between the submitter and BDC.

The submission must include the following:

- (1) A completed and properly signed copy of the form entitled, "Acceptance of Terms for Submission of Invention" (see Appendix A);
- (2) If a patent or patents covering the submission has been issued, one copy of each such patent must be included with the submission;
- (3) If a patent has been filed, a copy of the patent application (including claims and drawings) must be included. (Note--it is not a requirement that a patent be filed by the inventor. These two requirements apply only in the cases where patents exist or have been filed.)
- (4) A complete disclosure of the idea, concept or invention (including sketches and drawings if such sketches or drawings will help define the invention); an outline which may be helpful in preparing this is entitled, "Suggested Outline for Disclosure of Invention" (see Appendix B). (Note--it is important that this written description be as complete as possible while still being clear and concise, since it is on the basis of this that BDC performs its first screening.)
- (5) Comments concerning the market or potential market for the invention. The following list of questions indicate some of the points of interest. What type of market? i.e., consumer, industrial, service, etc. What is your estimate of the market size? Is the market price sensitive? What percentage of the market can the invention capture? Are there competitive products? Is it a world market?
- (6) Should a third party such as an employer, a former employer, a university, any organization, or an individual other than the inventor have any claim on the idea, concept or invention, the submission must contain a signed statement by such third party which waives this claim in a proper legal fashion.
- (7) If the idea or invention has been submitted to any other organization for evaluation, this fact should be stated and the reasons for the rejection included with the submission. If no such submission has been made prior to submission to BDC, this fact should also be stated.
- (8) If government funds have been involved in the conception or in any of the research and development that might have been accomplished or for any other reason the government has any claim to the idea, concept or invention, a statement should be included in the submission documents which explains the degree and nature of this government involvement. If there is no such government involvement, a statement of this fact should be included.

The submission comprised of the above-stated documentation may be sent to the following:

Invention Administrator  
Battelle Development Corporation  
505 King Avenue  
Columbus, Ohio 43201

European inventors may submit their invention submissions to either of the following:

BDC Associate  
Battelle Geneva Research Centre  
7, route de Drize  
1227 Carouge-Geneva  
Switzerland

BDC Associate  
Battelle-Institut e.V.  
Am Römerhof 35  
6000 Frankfurt/Main 30  
Germany

Once the submission is accepted by BDC, screening and evaluation will be initiated. This screening and evaluation will be performed at no cost to the inventor.

During this period the inventor may continue to attempt to dispose of his intellectual property by mechanisms other than through BDC. However, should any commitments to the property be made by the inventor to individuals or entities other than BDC, the inventor must immediately notify BDC of this fact.



## II. WHAT DOES BDC DO WITH AN INVENTION ONCE IT IS SUBMITTED?

When an invention submission is received, it is checked to see that the submission is in order (see Procedure for Submission of Ideas or Inventions to BDC). If in order, the submission is entered into our filing system, and the inventor will receive a letter which indicates the submission has been received. If the submission is not in order, it will be returned with notes describing the shortcomings. No submission will be accepted for evaluation unless it is in order.

### A. Screening

The submission is then screened by an appropriate member of the BDC staff. If the submission passes the Screening Step, it is then subjected to a Second-Phase Evaluation.

If the submission fails to pass the BDC screening tests, the inventor will be notified and given the reason for rejection. We do not notify inventors if their submission has passed screening. The initial screening procedure will be accomplished as soon as possible.

### B. Second-Phase Evaluation

After Screening, an in-depth evaluation is performed. During this evaluation, the technical feasibility of the submission is analyzed; the potential strength of the possible patent position is thoroughly examined; and the potential market for the process or product which results from the invention is studied. The three aspects may be examined simultaneously or in a specific order depending on the specific idea or invention being analyzed.

#### 1. Technical Value

An invention must be technically feasible--which means it must be reducible to practice (one way of saying the invention must be able to do what the inventor claims it will do) and also it must be economically practical (many inventions work but the cost would be so great that they are impractical). Therefore, BDC employs technical specialists in the field of the invention to study the invention.

#### 2. Patentability

For the most part, a licensee pays a royalty and any other license fee for the fact that the idea or invention can be protected from use by competition. The patent system in the various countries is set up to provide this protection from indiscriminate use.

This being the case, the inventor filing for a patent must establish that his idea is truly an invention. In most countries--the U.S.A. being one--the inventors' claims are examined by competent patent examiners who judge whether or not the invention warrants a patent. When BDC evaluates a submission, we attempt to make our estimate as to whether the invention would warrant a patent.

In addition, we also attempt to estimate whether or not a patent were to issue, whether it would be defensible in an infringement litigation.

If it is believed a patent might not issue, or if it is estimated that should a patent issue it would be weak, it is highly probably that BDC would not accept the idea for development.

### 3. Market

BDC attempts to determine whether or not there is or would be a need in the marketplace for the invention. No matter how good an idea is technically or how strong the patent, if it can't be sold, there is no chance for income. Unfortunately, we look at many ideas that fall into the category of having no market.

Reasons for lack of saleability vary greatly and it is the job of the BDC market specialists to determine what the potential market might be for the invention.

BDC uses its own experts, experts from the Battelle laboratories, outside consultants and industry itself to examine and analyze the market.

The total Second-Phase Evaluation could take between 6 and 10 months. Even after that amount of evaluation, the idea can be rejected.

#### C. Investment Decision by BDC

Assuming the results of the Second-Phase Evaluation are positive, BDC attempts to estimate the earliest point in development that industry will license. The cost to reach this point is estimated and compared to the estimated return to BDC in license fees and royalties. If the estimated return is considered to be satisfactory, BDC may decide to proceed with the invention and will offer to negotiate with the inventor.

#### D. Decision by Inventor

At this point, the inventor must decide whether or not he wants BDC to develop and license the invention.

The evaluation hasn't cost the inventor a cent.

If BDC continues in the development, the inventor will have to grant all right and title of the patent to BDC. In return, BDC will pay the inventor a share of any net income BDC receives from the invention. The percentage varies from invention to invention and therefore, must be negotiated for each case, however, it is generally between 30% and 60%.

If BDC does proceed with development of the invention, we may employ the inventor as a consultant, however, it should be clearly understood that BDC makes no commitment to do so.

#### E. BDC Development and Licensing

If a suitable agreement is mutually agreed upon, BDC will proceed.

### III. TYPES OF INVENTIONS NOT ACCEPTED BY BDC

For a number of reasons, BDC does not become involved with certain types of inventions. This being the case, should any invention within those classes be submitted, BDC will no doubt reject without screening or evaluation.

A list of the areas of no interest are as follows:

1. Liquor Industry
2. Tobacco Industry
3. Nuclear Power
4. Large-Scale Chemical or Other Heavy Industry Processes
5. Automotive "Original" Equipment
6. Musical Instruments
7. Games, Novelties, Sporting Goods, Weapons
8. Improvements or Substitutes for the Internal Combustion Engine
9. Building Systems
10. Products whose acceptance by industry are contingent upon legislation or upon administrative action by a government regulatory agency.

#### IV. WHAT ARE THE CHANCES AN INVENTION MAY BE SUCCESSFULLY COMMERCIALIZED?

We discuss this topic--not to be negative nor to be discouraging--but rather to be realistic--to prevent overoptimism and false hopes.

BDC is motivated to create successes because by so doing we increase our income and consequently, increase our resources to be able to handle more inventions. However, we also know--very few inventions attain any degree of success.

Another point to emphasize--it sometimes takes time. We believe good ideas take an average of about 7 years from invention to initial commercialization; once in awhile it is shorter, but then it can be longer. Therefore, please don't expect a sudden income flow--it normally doesn't happen like that. Also remember, of the inventions that are successfully commercialized, very few result in million dollar incomes for the inventor. That shouldn't discourage you, because most successful inventions do provide a reasonable amount of income, even though they won't put you in the millionaire class.